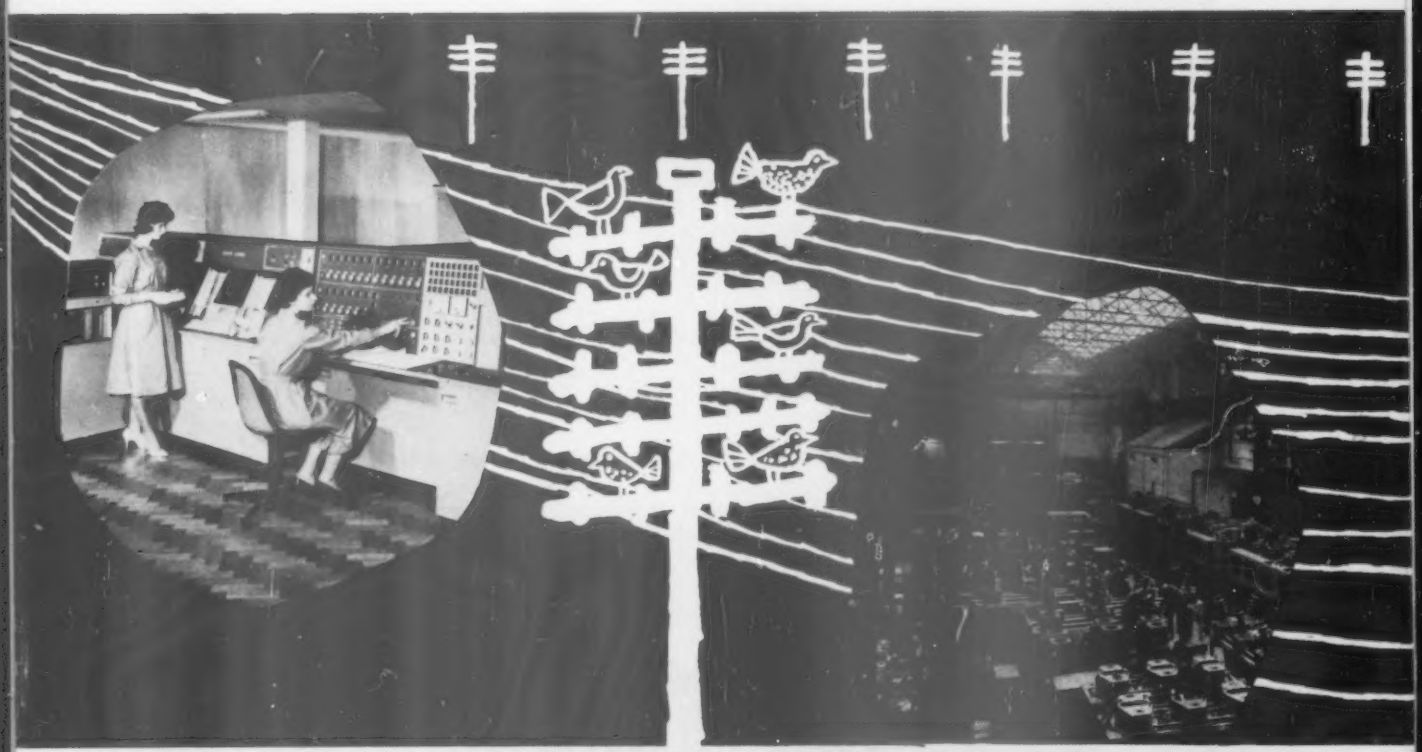
DECEMBER 1961 3/6

AUTOMATIC DATA PROCESSING

JOURNAL OF MANAGEMENT AND INFORMATION SYSTEMS



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AUTOMATIC DATA PROCESSING

JOURNAL OF MANAGEMENT AND INFORMATION SYSTEMS VOL 3 No 12

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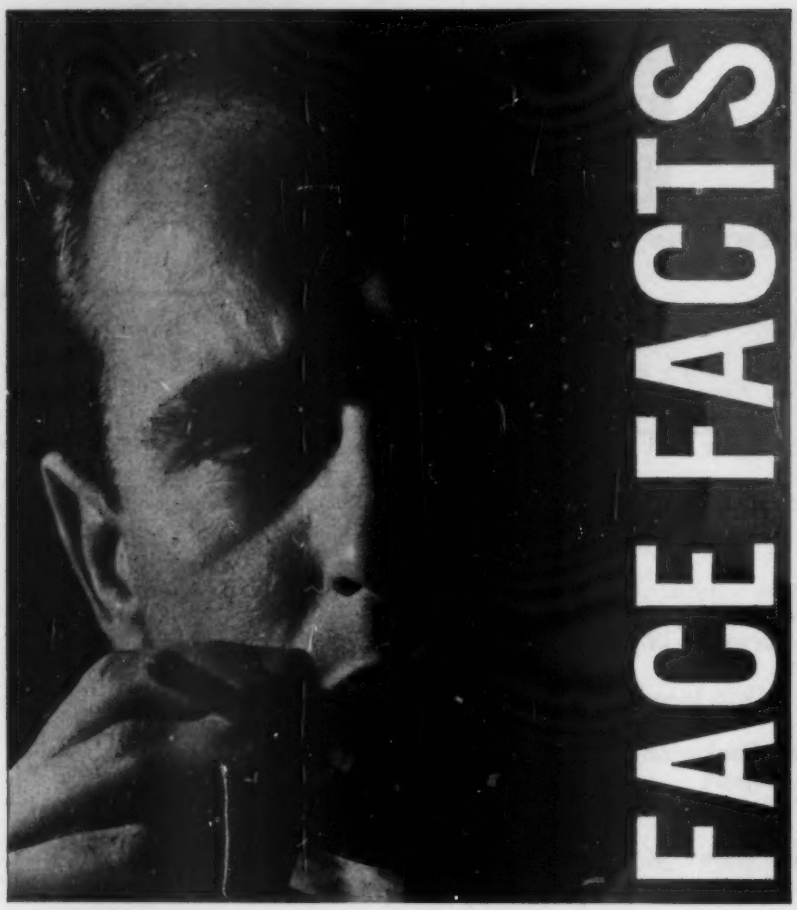

FACE FACTS

- Payroll
- Personnel statistics
- Order processing
- Production scheduling
- Production planning
- Stock control
- Purchase accounting
- Order invoicing and warehouse stock control
- Cost collection
- Costing and budgetary control
- Invoicing
- Sales ledger
- Sales statistics
- Sales forecasting
- Passenger and freight movement statistics
- Flight scheduling
- Centralised bank book-keeping for branch current accounts
- Centralised stock control and accounting for retail branches
- Retail prices index

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AUTOMATIC DATA PROCESSING

Opportunities in tens

PUSH out a subject like Britain joining the Common Market among any group of executives and you will discover that though the discussion may be sharp and short ('we can't ignore those millions of potential customers' or 'we can't let down the Commonwealth'), it serves to open the sluice gates on a gush of new thoughts about more vintage subjects—such as the competitiveness of certain old-established industries or the incentive to export. And somewhere in the cataract will be the old question as to whether Britain should change over to a decimal currency.

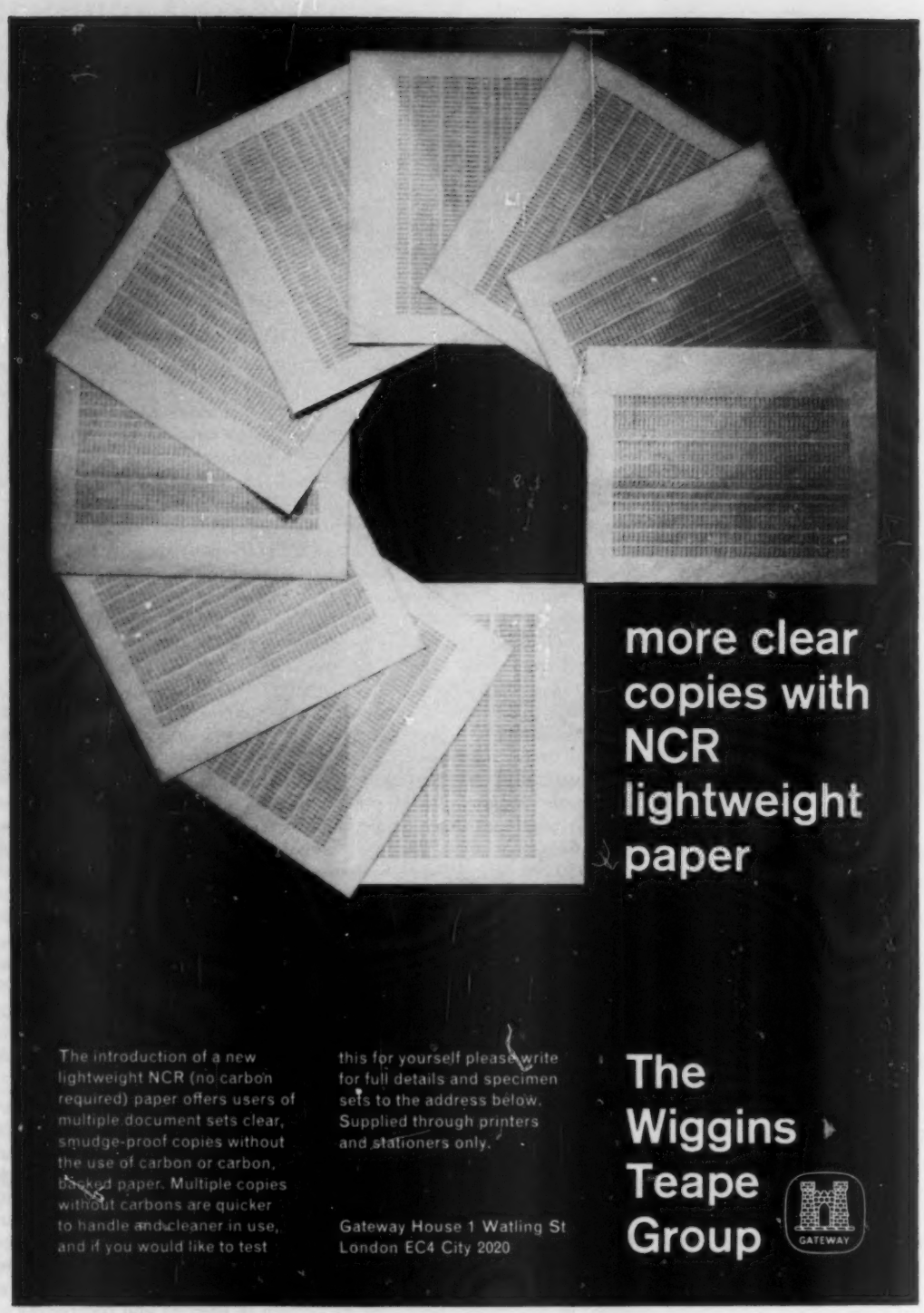
The Government are in fact to announce some time this month whether Britain will ' go decimal ', so that for once the topic seems rather more than academic.

During the middle of November the *Financial Times* published an article which contained some estimates as to what would be the cost to the country and to certain sectors of a changeover to a decimal system. The total cost to Britain might be of the order of £130 million—this would be the amount required either to adapt or replace various types of machines (from cash registers to petrol pumps) which operate in sterling. The benefits that would offset this considerable cost are obvious, but at the same time difficult to calculate precisely in terms of £ s d. Nevertheless a rough indication is provided by an Australian committee on decimal currency which reckoned that a switch-over might produce savings (in offices) of over £6 million a year and cost £32 million—in other words the cost could be written off (in Australia) in just over five years.

As the *Financial Times* article pointed out, in any currency reform ' by far the biggest item of expenditure would be on equipping industry, commerce and the public services with monetary machines that will operate on the new system '. This is certain, but what needs to be pointed out (and then stressed repeatedly) is that in having to re-equip, companies and public bodies would be provided with a unique opportunity: to adopt modern machines which would be more than merely decimal replacements for sterling machines. An example makes this clearer: there are an estimated 350,000 cash registers in operation in Britain, and a large proportion of these would need to be replaced; retailers would be faced with the choice of buying either decimal equivalents or more sophisticated decimal machines capable, for example, of producing paper tape records or even specially punched tickets (which could subsequently be used in automatic accounting systems). Retailers have been loth to invest in sophisticated cash registers, which are in effect point-of-sales recorders, because existing equipment (which was never cheap to buy) did one job nicely, thank you. This situation should change, and particularly if the equipment manufacturers can see the light in time and slash their prices.

* * *

For over a year now this journal has published a monthly Job Market Report in which the trends in available jobs in the data processing field (as portrayed in the situations vacant columns of three daily and three Sunday newspapers) have been reported. In 1962 we propose to extend this by publishing the results of a very thorough survey of jobs. Data processing managers, systems analysts and computer programmers are asked to help us in this survey by turning to page 43 and completing our Survey Form.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DATA DIGEST

Automatic Warehouses

Push button—goods come

About a year ago Solartron announced that they and John Brown Constructors had formed a new company—Solartron-John Brown Ltd—to manufacture and market the Gumpertz automatic warehouse system.* Now it seems that they are to have a rival in the field, since two companies of the Hawker Siddeley empire, Blackburn Electronics and Armstrong Whitworth Equipment, have combined to produce a prototype model of an electronically controlled automatic warehouse system.

By this method it is possible to select goods from overhead storage bins, either by operating switches or automatically by means of punched cards fed into a card reader. As the goods are dispensed from the bins, down a conveyor belt to a packing station, the system will generate an invoice, giving price, sub-totals and grand total, on completion of the order. The system will also notify the operator automatically when goods are out of stock.

The Blackburn Electronics automatic warehouse is still in the prototype stage, and Blackburn executives are chary of giving any indication of when it will be available, or how much it is likely to cost.

The Blackburn warehouse system releases items at a rate of five items a second; by contrast, the Solartron-JB system takes 15 seconds, from the time that the order has been taken, for five to 100 or more items to arrive at the delivery area. Automatic invoicing is part of the Blackburn system, but it seems as though on the Solartron-JB system this will be an optional extra. However, Solartron-JB have rather more than a year and a half start on Blackburn, and their first order, for a large food manufacturer, is likely to come on line either this month or early in 1962.

Australia looks to USA

Defence Ministry orders computers

One of the biggest computer orders signed in Australia—for four computers each worth £A850,000—has gone to the Minneapolis Honeywell Regulator Co, the Boston computer firm. The customer is the Australian Ministry of Defence which has just completed a three-year investigation into computer possibilities and available equipment. The 30-man committee, headed by Dr J Ovenstone, concluded that the Honeywell 800 computer provided the most advanced type of centralised and integrated system most suitable for defence requirements.

Ovenstone will head a team of 80 programmers and systems experts who will direct the four Honeywell 800s, which are to be housed in a special electronic data processing centre in Canberra, attached to the Ministry of Defence. A further 100 staff, from the services and other organisations, will be attached to the centre for research and development.

From where will the staff come? Honeywell are sending a team of computer experts to Canberra, and Ovenstone already has a nucleus of 18 trained staff. But to recruit 60 expert staff will be quite a headache for Ovenstone.

The Ministry of Defence is to have the first computer; the second will be put at the disposal of the RAAF (to be delivered by 1964), the third (for the Navy) and the fourth (for the Army) being delivered in 1966 and 1967. The complete administrative and

* See AUTOMATIC DATA PROCESSING, June 1960, page 25.

record keeping structures for the services have to be re-oriented around computers.

New ICT Machine

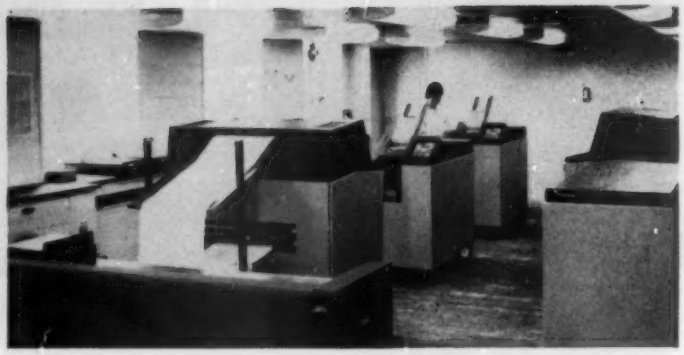
. . . is RCA 301

It was reported last month in the *Financial Times* that ICT had signed a contract with the Radio Corporation of America to take delivery of 50 RCA computers by 1964 with an option on a further 50 machines. The deal was said to be worth £20–£30 million.

When asked which of the RCA computers they had bought, ICT were reticent and refused to say, but it has been established that ICT are to import the RCA 301 and that the first of these machines is due to be delivered early this month to the company's Putney Bridge House offices. Informed sources say that ICT were sending executives to the USA to train on the 301 as long as nine months ago.

The significance of this deal is that the RCA 301 is a less powerful machine than ICT's own 1301 computer (the 301 is in fact competitive with the IBM 1401) and that ICT seem confident to place substantial orders for it. It should be recalled in this connection that the new machine recently announced by De La Rue Bull—the Gamma 30—is in fact the very same RCA 301 machine under a different name.

ICT Chairman Sir Edward Playfair is reported to have said that the RCA computers would fill the gap in ICT's production programme while they were developing their own new machines. This suits RCA's book, since they have spent so much on research during the last three to four years that their own earnings have been affected, so that new markets for their machines through the agencies of Bull, ICT and English Electric (whose KDP 10 system though manufactured in Britain



was designed by RCA) should help rectify this position.

RCA will market ICT punched card equipment in the USA.

Policies galore

Ensuring their updating

The Liverpool Victoria Friendly Society, an insurance company with assets worth £200 million have ordered an ICT 1301 computer, plan to keep track of 350,000 policies on it. This will involve accounting for 50,000 premiums a month and controlling 5,000 agents' accounts. In due course the Society hopes to put its 'industrial branch' work onto the system: this comprises 12 million policies.

Formica get it

All within the family

The second Gamma 300 series computer to be installed in Britain —the first went into fashion garments manufacturer Dorothy Perkins in June of this year—has been delivered to Formica Ltd. This is strictly in the family, since Formica and De la Rue Bull are all part of the De la Rue organisation, but, as one Bull executive remarked with feeling 'that does not mean that our life is made any easier in planning the installation.'

The computer will go into Formica's London office, but much of its work will be for the company's principal factory at Tynmouth. The necessary data links between the two locations are maintained by a new data transmission system, Tradan.

The computer will come on line in April, 1962, and its first tasks will be to handle weekly production schedules, statistics (weekly, period, quarterly) and acknowledgements of customer orders. Through the integration of routines it will be possible to produce customers' advice notes and invoices and transmit the relevant information directly down the Tradan link to the factory; available warehouse stock will be under continuous scrutiny and will be automatically allocated.

The computer will also handle factory costing in certain of its aspects, payroll, and—in due course—the maintenance of the sales ledger.

Survey of Salaries

AUTOMATIC DATA PROCESSING is conducting the first survey of data processing salaries in Britain.

Installations managers, systems analysts and programmers are invited to help us in this survey by turning to page 43.

Set-up changed

Spillers re-shape systems

Centralising their sales accounting in their new head office, Spillers Ltd have placed a £200,000 order with National Cash for an NCR 315 computer with Cram random access memory storage.

Cram was decider

When the computer is delivered the work of pricing orders, compiling printing invoices, maintaining sales ledger records, and producing sales analyses, at present distributed between five area offices and head office, will be turned over upon it.

The area offices will maintain existing relationships with customers, but will be able to reduce the amount of recording necessary to the minimum. Customer records for all the Spillers' lines, animal feedstuffs, grocery products and flour, as well as the better known pet foods, will be held in computer files. In addition to this information, details of sales contacts will also be held as well as price lists of both current and recent prices. Up to 22 million characters will be available in the Spillers installation at any one time. Invoices will be produced daily, amounting to several thousand records, on the printer at a speed of 680 lines per minute. Delivery details are to be fed to the machine on the paper tape. Sales statistics will be accumulated daily, and printed out in weekly or monthly form as required.

Batons tell

But Bull sorter is versatile

Now it is the turn of the European banks. This time last year the electronics sub-committee of the British clearing banks chose the E13B magnetic character system as the standard typefont for automatic cheque sorting. Will Europe follow suit, or will the Bull CMB (caractères magnétiques en battonets) now rechristened CMC7, get the vote?

Bull seem confident that their code will be chosen, and to reinforce their convictions recently brought out—and demonstrated to French, German and British banking representatives—a brand new reader/sorter, the Bull TL900. This sorter, which is a development of the equipment used by Crédit Lyonnais, is able to handle 900 documents per minute, with a considerable thickness tolerance, and with variations in length between four and eight inches, and in depth between three and six inches.

The TL900 uses the Bull code, but it is, of course, possible to modify the equipment to allow the machine to operate on the E13B code.

SERVICE BUREAU PIONEERS

THE first comprehensive service bureau in Britain to be set up by a commercial organisation independent of the computer manufacturers is being established by Computer Services (Birmingham) Ltd in Birmingham. Long-established in the accounting services field, Computer Services have selected a Remington Rand Univac Solid State 80 machine, which is due to be delivered to new premises in Smallbrook Ringway, Birmingham, early next year. Already 56 preliminary surveys have been conducted of potential customers' needs, and inquiries are flowing in at a rapid rate. They come not only from Midland companies but from the South of England and as far afield as Belfast.

With the £100,000 computer any job will be tackled, including payrolls, market research, sales invoicing and analysis, dividend warrants, stock and production control, scientific work, etc, although the bureau will specialise particularly in payroll work. Services will range from undertaking a complete job, right from the initial survey, to taking over an operation at any stage, or allowing customers to hire time on the machine and to use their own staffs. It is intended that the computer will be in operation 24 hours a day, seven days a week.

Computer Services have already taken on a staff of 15 systems analysts and programmers, and the number will grow quickly. Under the direction of Mr V J Barlow, the computer manager (who came into computers from the engineering side of guided missiles in 1954, was on technical

V J BARLOW
missile man

MISS MURTAGH
comptometer don

computer applications for Armstrong-Siddeley Motors, of Coventry, and was then system analyst and chief programmer for Tube Investments Ltd immediately before his present post), representatives are having preliminary talks with firms, followed by systems analysis and then, if a firm wishes to proceed, on to preparation of computer programs.

The charge for work on the computer will be £20 an hour, and, for that, Computer Services say they can offer (in one hour) the calculation of gross to net payroll for 5,000 employees; the processing of 2,000 sales invoices; a stock control run for 5,000 items; the production of 2,000 statements; or statistical analyses of 25,000 items. The cost of gross to net payroll will work out at between 4½d and 9d per payslip according to the size of a firm. (Performance of the machine is: 600 cards a minute on the card reader, 600 lines a minute on the printer, 150 lines a minute on the punch, and the central processor has a memory of 30,000 digits.)

The Univac will be housed in a corner of a 10,500 square feet room in the new premises now nearing completion on the corner of Bromsgrove Street and Hurst Street, Birmingham. These premises, costing £100,000 to build, will give Computer Services much-needed space and a prominent site in an area of Birmingham that is rapidly being redeveloped. The computer room is to be air-conditioned to meet temperature, humidity and dust-free requirements.

A computer service bureau is a natural development for a business which has been in the accounting field since 1938. It was originally founded by Miss Marion Murtagh, AACCA, ACIS, joint managing director, at the Calculating Bureau and the Comptometer Students' College. The bureau undertook every type of commercial calculating and also supplied comptometer operators to work at clients' offices.

COMPUTERS INSTALLED DURING 1961

Listed below are the various computing systems known to have been delivered to customers in Britain since 1 January, 1961. As some computer manufacturers are reluctant to provide information on orders and deliveries this list and a companion list on page 9 may be incomplete in some respects.

De La Rue Bull Machines Ltd	
300 Series	Formica Ltd
,,	Dorothy Perkins Ltd
IBM United Kingdom Ltd	
IBM 7090	IBM Newman Street Data Centre
IBM 305 Ramac	Joseph Burton
,,	C and J Clark (2nd installation)
,,	Caterpillar Tractor Co
IBM 1401	Mars Ltd
,,	Bank of Scotland
,,	IBM Newman Street Data Centre
,,	Royal Army Pay Corps, Worthy Down
IBM 650	National Coal Board
,,	Prudential Assurance Co
EMI Electronics Ltd	
Emidec 1100	Barclays Bank
,,	J Sainsbury Ltd
,,	BEA
,,	Air Ministry
Emidec 1100	RN Stores Department — Scheduled to be installed in 1961
Emidec 2400	Ministry of Pensions — Scheduled to be installed in 1961
,,	RAOC Chilwell — Scheduled to be installed in 1961
English Electric Co Ltd	
KDP 10	Kidsgrove Computer Centre
KDN 2	Kidsgrove Computer Centre
Ferranti Ltd	
Atlas	Manchester University
Pegasus 2	DSIR, Road Research Laboratory
,,	Vickers Armstrong (Weybridge)
,,	De Havilland Aircraft Co Ltd
,,	Martins Bank Ltd
,,	Westminster Bank Ltd
Mercury	British Petroleum Co Ltd
Sirius	Ferranti (Newman Street Computer Centre)
,,	Yarrow and Co.Ltd
Apollo	Prestwick Airport (Air Traffic Control)
ICT Ltd	
1301	ICT Putney Centre
1202	Carreras
,,	Cardiff Corporation
Leo Computers Ltd	
Leo IIc	Ford Motor Co
National Cash Register Co Ltd and Elliott Brothers (London) Ltd	
802	British Aluminium Co Ltd
405	North Western Gas Board, Altrincham
,,	Newton Chambers and Co
803	GPO Research Station
,,	Godfrey Phillips
,,	Bristol College of Science and Technology
,,	N-E Computing Service Marylebone
,,	Panellit Ltd
,,	Elliott Bros (London) Ltd (2)
,,	The Lummus Co Ltd
,,	G A Harvey and Co (London) Ltd
,,	NCR City Computer Centre, London
,,	Brunel College of Technology, London
Remington Rand Ltd	
Univac Solid State 80	Remington House, London
Standard Telephones & Cables Ltd	
Stantec	University College of South Wales
,,	Leicester College of Technology
,,	Borough of Hornsey

WHO ORDERED WHAT IN 1961

(does not include export orders)

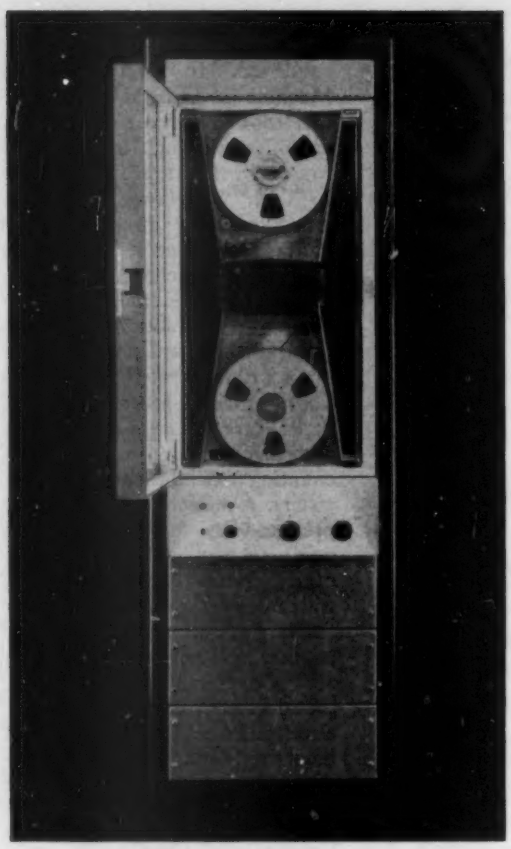
Company or Organisation	*Computer*
Aberdeen University	N-E 803
AEI Rugby Ltd	AEI 1010
Applied Ballistics Department Ordinance Board	N-E 803
Babcock and Wilcox Ltd	Ferranti Argus
Bank of Scotland	ICT 1301
Battersea Technical College	Ferranti Sirius
Bedford College of Advanced Technology	Stantec
Birmingham University	English Electric KDF9
Boots Pure Drug Co	De La Rue Bull 300 Series
British College of Science and Technology	N-E 803
British Nylon Spinners	IBM 1401
British Railways, Midland Region	Ferranti Sirius
British Railways	ICT 1301
Brush Electrical Engineering	N-E 803
Brown Brothers Ltd	N-E 803
Builders Copper Tube Ltd	Ferranti Sirius
Carreras Ltd	ICT 1301
C and J Clark	IBM 1401
Caterpillar Tractor Co	IBM 1401
CAV LTD	Leo III
City of Portsmouth Corporation	IBM 1401
Clydeside Supply Co	Emidec 1100
Computer Services Birmingham Ltd	Univac Solid State 80
Consett Iron Co Ltd	IBM 1401
Coutts and Co	Univac Solid State 80
Dorman Long and Co Ltd	IBM 1401
Dunlop	Leo III
Eire Revenue Commissioners	ICT 1301
Esso Petroleum Co Ltd	IBM 1401
Esso Petroleum Ireland	ICT 1301
Exeter University	N-E 803
Ford Motor Co Ltd	Leo III
Formica Ltd	De La Rue Bull 300 Series
GPO	N-E 803
General Accident, Fire and Life Assurance Co	IBM 1401
Gillette	IBM 1401
Glasgow Technical College	Ferranti Sirius
Glasgow University	English Electric KDF9
Goodyear Tyre Co Ltd	IBM 1401

(*continued on page 10*)

The business grew until it had a staff of about 100 permanently employed. In 1947 the Adding Machine Co Ltd was formed and this took over both the former activities, although they are still run under the original names. In 1953 Mr W J Powell, the other joint managing director, joined the company, and it was decided to set up a punched card department to prepare cards for customers' own installations, to undertake punched card processing for firms without their own installations, and to process punched paper tape incorporated as an additional feature on some accounting machines and cash registers. A million cards a week are produced by the 300 operators now employed on the work. Computer Services (Birmingham) Ltd, which was set up this year, is now the largest service bureau in the country, and among its customers are Government departments, motor, metal, chemical, aircraft, electrical, steel and canned food industries, and also market research, statistical and insurance companies. The company is jointly owned by Mr Powell and Miss Murtagh (who takes part in activities such as those of the British Institute of Management, etc).

Computer Services has other new activities up its sleeve. Training courses in programming are to be held for staff of Midland companies, and the first of these starts this month. It is also proposed to operate a paper-tape processing service in connection with the computer. The paper-tape-by-product of accounting machines used by customers will be fed into the Univac system to produce analyses of all kinds. At present Computer Services are equipped with paper tape-to-card converters, but it may eventually be possible to feed information on paper tape direct into their computer, as it is understood Remington Rand are developing paper tape readers for their USS 80 machine.

R W WILCOX



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For details, write for literature packet TM-44B to: Ampex Great Britain Ltd, 72 Berkeley Ave, Reading, Berkshire. Telephone: Reading 55341.

WHO ORDERED WHAT IN 1961

(continued from page 9)

Company or organisation	*Computer*
Thomas Hedley	NCR 315
The Herbert Morris Group	IBM 1401
Heriot-Watt College	Ferranti Sirius
Herts County Council	NCR 315
Hornsey Borough	Stantec
ICI Paints Division Ltd	IBM 1401
Institute of London Underwriters	ICT 1301
Leeds University	English Electric KDF9
Leicester College of Technology	Stantec
Leicester Permanent Building Society	N-E 405
Lewis Investment Trust	ICT 1301
Lewisham Borough	IBM 1401
Liverpool University	English Electric KDF9
London University	Ferranti Atlas
London University	ICT 1301
Manchester Regional Hospital Board	IBM 1401
Mersey Docks Ltd	IBM 1401
Metal Box Co Ltd	Ferranti Orion
Mullard Ltd, Southampton	N-E 803
Mullard Research Laboratories, Salford	N-E 803
Norwich City Treasurer's Office	N-E 405
Panellit	N-E 803
Reading University	N-E 803
Remington House, London	Univac Solid State 80
Retfords Ltd	IBM 1401
Richard Thomas and Baldwin, Newport	N-E 803
Royal Exchange Assurance	De La Rue Bull 300 Series
Royal Army Pay Corps	IBM 1401
Royal London Mutual Insurance Society	IBM 1401
Royal Radar Establishment	N-E 803
Rubery Owen	ICT 1301
ROAC, Donnington	Emidec 2400
Scottish Coal Board	AEI 1010
Scottish Commercial Bank	IBM 1401
Scottish Co-op	IBM 1401
Shell International Petroleum Co	IBM 1401
Shell Mex and BP Ltd	Leo III
Tate and Lyle Ltd	IBM 1401
William Timpson Ltd	Univac Solid State 80
UKAEA	IBM Stretch
UKAEA	Ferranti Atlas

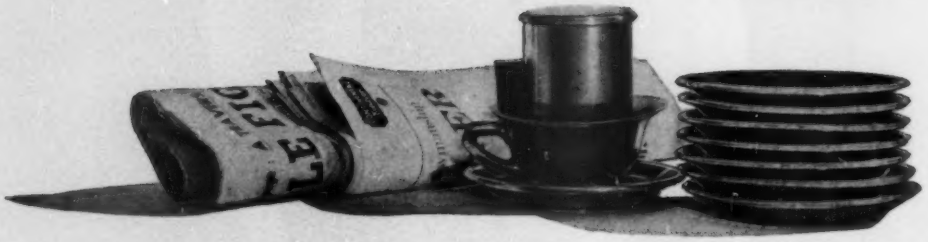
Ampex TM.2 maximises computer through-put

The overall average speed at which your computer tape passes the heads of this machine determines the through-put of your computer installation, and its efficiency. Just as in a good road racing car, high top speed is not enough. Both machines must be able to reach speed quickly and stop quickly, in order to maintain a high average. This is where the British-made Ampex TM.2 excels. Reliable start times of less than 2.0 milliseconds to plus or minus 10 per cent of nominal speed, and stop times of less than 1.5 milliseconds assure maximum through-put and, at the same time, minimise dead space on valuable computer tape. This exceptional performance, achieved without any sacrifice in machine reliability or tape life, derives from the TM.2's advanced electro-mechanical design based on three years' extensive field experience with the Ampex FR.300 Computer Tape Handler. As with other Ampex equipment, the TM.2 is backed up by a competent organisation of sales and service engineers, both in the United Kingdom and on the Continent. Parts are immediately available from Ampex Electronics Limited. The sound design and advanced capability of the new Ampex TM.2 is attested by the fact that nearly every major British and European computer manufacturer has already selected it for high-speed on-line use in their systems.

For complete technical specifications and full details of performance data on the TM.2 and on Ampex 800 Series Computer Tape, write for literature packet TM—44B to: Ampex Great Britain Limited, 72 Berkeley Avenue, Reading, Berkshire. Telephone: Reading 55341.

AMPEX

l'addition!



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DTV

How to Transmit Business Data

P Wright

● **HOW IT CAN BE DONE** ● **WHAT IT INVOLVES** ● **WHAT IT COSTS**

OVER the past year considerable enthusiasm has been engendered over the possibility of using the public telephone network for carrying business-type data to computer centres.

As if to substantiate the entity of this topic, labelled 'data transmission', several computer and communications firms showed pieces of equipment at the computer exhibition last October that have been designed for this very purpose.

Although these demonstrations proved the reality of this new technique, it was none too apparent just what advantages could be gained from such units, or what their cost would be. So it is worthwhile to attempt to unravel some of these problems.

With the introduction of any form of automatic data processing centre, there exists a demand for some method of feeding-in basic information from a variety of collection points. This can be achieved by postal or messenger service, and by telephone or radio type data handling links.

Although all of these are essentially forms of data transmission, it is the last two methods that are embraced by the more specific meaning in current use today.

There are two main reasons for the inception of this type of information communication. One concerns the actual use to which computer data processors are put, and the other is more directly concerned with the speed of operation of electronic computing circuits.

Automatic data processing techniques have been introduced in many companies as a method of obtaining fast and accurate management control. If an organisation has one or more remote branch offices, distribution points, or production plants, there is automatically a delay in time before all the requisite information relating to company activities can be collected and processed by a central data processing service.

Modern business practice in a competitive economy is such that delays of one to two days, inevitable with conventional communications, may be very costly.

The use of telephone type data links between branch offices, warehouses, etc, and a central control point can enforce a speedier management information service and produce considerable savings. The type of savings envisaged are not so much direct, but the result of increased business handling capacity and higher productivity.

In addition to this, modern electronic computing systems are extremely fast in operation, and involve high capital costs. To obtain maximum usage of machine time for economic running, it is necessary to have all data to be processed well in hand. This can be achieved even with tens of outstations feeding a centre.

Each outstation may feed a central store which the computer automatically interrogates at an appropriate time, or it may feed into a reservoir which is later incorporated into a data processing

run by conventional methods. A third technique is available in which small computers can automatically communicate with a larger central machine.

PRESENT EXPERIENCE

How these varied approaches are used is considered later, but it is useful to consider first some of the few examples of data transmission that are in current use in Britain, before investigating available equipment and something of its costs.

These brief examples serve to show that data transmission has already progressed a long way beyond the research stage, and is in fact making a useful contribution to both large and small users of automatic information handling techniques.

An early pioneer of its application was Belling and Lee Co Ltd. This firm used it to transmit data between its processing centre at Enfield, Middlesex, and a factory in Liverpool.*

To achieve successful integration for this operation, it was necessary to establish daily contact between the two plants.

Relatively speaking, the quantity of data exchanged was not large, and so in communication terms a slow speed transmission system adequately copes with the traffic involved. To effect communication a machine which could both read and punch standard 80-column cards was connected to each end of a private rented GPO telephone line.

These dual purpose transceivers can reproduce cards at the rate of 16 columns per second. The format of a reproduced card can be an exact copy of the original, or it can be edited by means of a control program, program cards mounted in both transmitter and receiver, and control data punched into the transmitted card.

The transmitter and receiver are automatically synchronised, and additional checks ensure accuracy of reading and punching by comparing the number of characters punched with the number of characters read.

On a far larger scale ICI has been using its own private telex network for transmitting computer-type data between its computer service bureau at Wilton and users situated at up to 60 distant locations throughout the country. In this instance the users are scientists and mathematicians who have been tutored in programming. They prepare their programs and transmit them, together with the relevant information, for handling by the service bureau staff. More than 100 people have been trained in programming techniques, and the manpower savings of this system combined with use of the telex network for rapid solution of problems are apparent.

For business purposes, however, some of the most valuable experience has been gained from work by the Commercial Union Group of Assurance Companies. For more than eight months the group have been sending routine data over the public telephone network between Brighton and Exeter. The object of this operation was to establish the feasibility of sending information to the Devon centre (which is being equipped with a large modern computer to integrate data processing for the group) from some 40 branch offices all over the country.

At Brighton all routine paperwork has stopped and an electric typewriter is being used to page-print and at the same time operate a paper tape punch.

The perforated tape is fed into a tape reader equipment which transmits over the switched telephone network. In addition to regular work, daily test transmissions have been made to establish what type of errors are likely to be encountered on the line.

This whole operation has been organised in conjunction with the GPO, since general approval for using the public telephone network for data transmission has not yet been granted.

The Commercial Union system operates (*ie.* transmits from point to point) at 750 binary digits a second. Using a 7-unit code the effective speed of operation as far as useful business data is concerned is 62 characters a second.

Each of these examples provides useful study in that they embody the three principal methods of operation that are likely to be of immediate value to the computer user, and for which equipment is available. All three methods also offer varying speeds of operation at varying costs.

HOW IT IS DONE

To the equipment designer the most important single facet of a line working system is its bandwidth. This is the standard characteristic of the link that determines the maximum speed at which information can be carried by it.

Telegraph channels, for example, carry a string of on/off signals, or pulses and non-pulses. These pulses are produced by a morse key-type action. That is, when a switch is pressed an electric current is produced in the circuit and when it is released the current drops to zero.

The telegraph circuit has a low bandwidth and will only carry about 60 pulses a second. This is equivalent to 60 binary digits, and using a 5-unit code amounts to about 12 characters a second. Some of these characters are used for control purposes, and so something like 20 percent of the data could be lost for pure business information.

This is a considerable drop compared with the

* An outline of Belling and Lee's production control methods was published in last month's issue of AUTOMATIC DATA PROCESSING. The company's Liverpool factory is no longer operational so that the data links are not at present in use.

THE COST OF USING GPO LINES

TYPE OF LINE	PRACTICAL SPEEDS (*in bits per second*)	COST (*for 50 miles*)	CATEGORY
Telegraph (Private)	50 bits/second	£500 a year	Slow speed
Telephone (Private speech type)	2,500 bits/second	£700 a year	High speed
Music (Circuit private)	5,000 bits/second	£1,260 a year	Very high speeds
Special Circuits	48,000 and above	Special Costing	Multi-channel high speed links using machines in parallel
Switched Telex	50 bits/second	1 shilling for 3 minutes	Low speed
Public Telephone	600 bits/second	1s. 6*d*. for 3 minutes	High speed

speeds attained on the Commercial Union system. On the other hand, conventional punched card and paper tape reading machines are more suited to linking with telegraph lines, whereas the telephone link demands far more sophisticated techniques and special equipment before transmission is possible.

Nevertheless telephone circuits have the advantage of greater bandwidth and therefore greater data handling capacity.

Although private telephone circuits are available on a rental basis for high speed working, the cost of such a network may be uneconomic.

Costs of renting the various types of lines and their performance is shown in the table above.

Because of these costs private enterprise is looking to the time when the public network becomes available to data transmission, so that the cost of using transmission networks is based on the actual time of use. This, however, neglects the capital cost of the special equipment which is *not* cheap.

Direct transmission over telephone lines, as outlined for telegraph circuits, is out of the question for several reasons. The telephone line has a bandwidth of 300 to 3,000 cycles compared with 0 to 120 cycles on the telegraph link.

Part of the telephone band, however, is used by the GPO for control purposes, and although the frequencies involved in speech communication do not interfere with these control signals the pulsed data as used in the transmission of business data does have an effect.

To overcome this difficulty data-couplers, called ' modems ', have been designed which link reading machines to the transmission lines. Modems in fact translate the pulsed signals produced by data processing equipment into voice frequency-type signals at one point and convert them back into reproducible data at the other.

NETWORKS

A multi-terminal data link system can be organised in one of three ways according to the role it plays in the overall data processing complex, and according to the economic dictates involved in the cost of high and low speed transmission.

▶ The most straightforward case involved direct transmission from a number of outstations to a central computer centre handling and processing all the information for an organisation spread over a large area.

Operation of the communications link will depend on the processing schedule prepared for the computer. If, for example, data collected at the remote locations during the day are not required for processing until first thing the following day, then data can be fed over low cost lines at low speed. If on the other hand the information is to be processed whenever computer time becomes available for short periods during the current working day, then concentrated periods of high speed transmission are inevitable.

▶ The second type of operation could involve a system which incorporates small computing facilities that partially process data for branches or depots in a restricted area. At allotted periods these data are fed to the main computer centre.

Such a system is applicable to a national sales organisation, for example, which maintains area

sales control but obtains all supplies from a central distribution warehouse. The local centres prepare area statistics for local management action, and at the same time provide the necessary information so that supplies are automatically prepared and future production programmes ascertained at head office.

▶ The third system involves direct computer-to-computer links. High speed links in such an organisation are unavoidable in order to match anywhere near the speeds of the machines. This is perhaps one of the few examples which could justify using a radio-type link with exceptionally high capacities.

There is yet another possible type of data link that does not connect direct with a computer centre, although some form of processing may be involved. In effect the hub of this network is an information collection and distribution agency. Its purpose is to store information fed from several local sources, and then at a scheduled time channel all this data down one main line to some distant computer processor.

Low speed lines would in all probability be adequate to feed from the local stations to the message distribution agency, whereas a single high speed channel would be needed for the secondary to the distant computer centre.

MAKE THE EQUIPMENT FIT

This type of organisation would be considerably cheaper than one using independent lines between all the out-stations and central computer unit.

From these broad considerations it is apparent that, for successful application, the introduction of any type of automatic communication method must be considered in relation to the work of the complete system of which it is an integral part.

The situation has tended to become confused, unfortunately, with the increased appetite of high speed and high capacity computers. To satisfy this demand of modern machines is not in itself the sole justification for employing data links.

Available Modems

Made by:	Speed of working (in bits per second)
Bell (Dataphone)	1,200
IT & T (Sweden)	1,500
Friden (Tradan)	200
AT & E (Swift)	2,500
Marconi (under development)	300
Ericsson (430A)	500
Collins	3,000
RCA (130)	600
Ferranti	700

As already stated, the type of line used for transmission determines the speed of working of the network. This also determines, to a large extent, the type of equipment that is suitable for producing the basic data.

For example, punched card and paper tape machines will be in many cases adequately fast in operation to cope with both the sending and receiving of information. Tape-to-tape links, however, will generally be only justifiable for high speed working.

Nevertheless the two types of links are complementary for specific purposes. In the case of the message distribution set-up the local stations could use card or tape machines for sending information to the collection point where it would then be recorded on magnetic tape. The magnetic tape handlers in turn would transmit over high speed channels to similar equipment.

This approach, of storing data on magnetic tape, has other possible uses. Since night telephone transmission rates are cheaper than daytime rates, all information sent over the public network could be stored automatically on tape during night transmission.

This reservoir of data would then be ready for processing immediately the computer run starts.

An important factor to be remembered in looking at these considerations is that they are based on the fact that most computers in this country are still used on more or less office hours bases. Once two or three shift working becomes a standard practice, in order to achieve maximum utilisation of machine time, the need for direct information links will be increased.

DETECTING ERRORS

With the use of communication networks the user will obviously want to know what reliability he can expect from telegraph and telephone lines.

Both the GPO and communications firms have been examining this subject for some time. Extensive tests over telegraph networks have revealed that error rates are on average in the order of one in 40,000 characters transmitted. By incorporating simple error detection techniques, this rate can be reduced to one in a million. With even more complex methods this problem can be resolved almost completely.

A variety of ways have also been developed for achieving error free transmission over the high speed speech type networks. The use of error detection or automatic detection and correction facilities again depends upon the particular use of the overall system.

The cost of additional equipment needed for these techniques used in their more complete form is likely to be very high.

Several simple detection methods are available.

SOME COMPLETE DATA TRANSMISSION SYSTEMS

Made By	Description	Type of Operation	Speed in Bits per second
IBM	1001 (uses Bell Dataphone)	Card-to-Card	100
	Transceiver (uses Bell Dataphone)	Card-to-Card	1,200
	7701 (uses Bell Dataphone)	Magnetic tape-to-magnetic tape	1,200
Automatic Telephone and Electric	Swift (plus tape readers and punches)	Paper tape-to-paper tape	750
Ferranti	Data link DL2	Paper tape-to-paper tape	700
	DL3 DL4	Paper tape-to-computer	700
Ericsson	Digital data link equipment 430 A	Paper tape-to-paper tape	500
Friden	Traden	Card-to-card Paper-tape-to-paper tape	700
Marconi	Data transmission system under development	Card-to-card Paper tape-to-paper tape	300
Collins	Kineplex (plus IBM card equipment)	Card-to-card	3,000
	Kineplex magnetic tape system	Magnetic tape-to-magnetic-tape	3,000
Digittronics	Dial-o-verter (plus Bell dataphone)	Card, paper tape-or magnetic tape	1,200
RCA	DaSpan	Paper tape-to-paper tape	75

In one case the transmitted data is organised in such a manner that any change in format is automatically recognised; alternatively a complete message can be transmitted twice, and the two compared character by character; or again it is possible to compare received signals with the original transmission data by using a return path.

The choice of whether to cease transmission immediately an error is detected and investigate, or whether to investigate errors all together after complete transmission is largely dictated by the volume of information handled and the detection techniques involved.

Mainly because there are few examples of successful data transmission systems operating, little costing seems to have done for complete systems. The GPO, however, has explored the problem and produced some fairly clear guides for potential users.

On slow transmission networks, for example, it has been suggested that the telex system is most economic if transmission times amount to no more than 45 minutes a working day, while telephone lines are more suitable if this should amount to over one and a half hours transmission.

A comparison of the rental chart for GPO lines, however, reveals what part of the cost of a data link these lines will be.

For a 50-mile private line link, for example, the difference between rental of a telegraph and telephone link is £200. For this difference in price there is a 30 to one difference in the possible speeds of operation.

On the other hand a modem will be needed for linking data reading and punching equipment to the telephone line, and the cost for each piece of terminal equipment is likely to be about £3–4,000. at the moment.

The ratio between speeds of operation over the switched telex and telephone networks is 50 to 750 binary digits. For three minutes working over a 35 mile circuit, the telex costs sixpence and the telephone one shilling.

Against this, however, it will take 45 minutes to send the same quantity of data over telex that can be handled by the telephone line in three minutes.

At the low speed rate of transmission—50 binary digits a second—45 minutes working provides time to handle more than 20,000 characters of information (in 5-unit code). This allows for 20 percent of the system's capacity that is used for error checking purposes.

Systems for an

AUTOMATIC CIGARETTE FACTORY

Keith Bean

WHEN Prince Philip moved a switch to set in operation the new automatic pneumatic tobacco feed system at Carreras' Basildon factory last year, the first fully automatic cigarette factory began operating.

There is indeed a high degree of mechanisation in this 12-acre Essex new-town complex, from the vast hogsheads of tobacco leaf (some 4 million pounds in the bonded warehouse) to the conveyors in the despatch department whence supplies go out not only to the home market but as far afield as Chile, Persia, Zanzibar, Malaya and Fiji.

Rotary knives take off the tips of the leaf, threshers separate the stem from the lamina (the soft leaf), vibrating conveyors carry the lamina to bulking and blending silos, rotaries guillotine it into fine shreds to be blown along the pneumatic conveyors to silos which automatically fill and discharge. Then the tobacco goes through a range of sophisticated making, drying and packaging machines, including an electronic analyser which enables the operator to check at a glance the weight and filling of cigarettes from all the different making machines.

Yet appreciation of the value of mechanisation in the factory is not always reflected in an equally efficient approach to the office work. Is it here? In recent years, most certainly yes. The company already have an ICT 1202 computer and will receive its replacement, a 1301 machine, in the middle of 1963.

The modernisation has been carried through despite the complications of change in financial control, change of location (from London to Basildon) and even change of name.

The Basildon works are now the headquarters of Carreras Rothmans Manufacturing and Distribution Ltd. When the Rembrandt Tobacco Corporation bought into the old-established firms of Rothmans of Pall Mall (1890) and Carreras (1788) it was decided that there should be combined production and office units and a combined sales force. This year, however, a separate sales force was re-established and Carreras Rothmans Manufacturing and Distribution Ltd came into being to provide the combined distribution services—sales ledger, orders, statements and so on—for them and to market all their brands—Craven A, Piccadilly, Guards, Barons, Rothmans King Size, Peter Stuyvesant and Consulate.

With over 2,000 workers the company is the biggest employer of labour at Basildon. The office staff at present occupies part of the factory but it will move to the new 6-storey administration block which will be finished this month. The data processing department which will be on the ground floor comprises a team of programmers, a systems analysis team, the Hollerith machine room, computer and punch sections.

The transfer of the office from the exotic-fronted premises in Camden Town to Basildon was a major operation. Many of the office staff preferred to live in London and would be lost to the company when the move was made. Carreras' answer was to recruit Basildon girls six months before the move.

The new girls were taken up to London every day by special coaches and trained alongside the existing staff. The result is that now all the company's punch and computer operators and a large proportion of the machine room operators are from Basildon, and work near their homes.

FIRST THOUGHTS

As early as 1956 the Carreras people were thinking in terms of computers as a possible means of more efficient and economical office working, to cope with expansion of the business and to

provide information for more effective management control.

At that time they had a modern and comprehensive Hollerith punched card installation, including an electronic calculator, which was used for invoicing and sales ledger accounting, sales analysis, wages and incentive bonus payment (including some automatic analysis), material and engineering stock records, and bought ledger and export ledger accounting.

A detailed feasibility study on computers and extensive senior staff training culminated in June, 1957, in the order for a 1202, whereupon the O and M staff was augmented and a programming team was set up. The 1202 was delivered in October last year, began operating in December and by March had taken over the payroll and labour costing routines.

In this procedure employees are located in departments which for convenience are grouped into ten separate group payrolls. Information for each employee, held on 80-column ICT punched cards, is in two categories: (a) constant or static information like PAYE tax code number and basic pay, and (b) changing information like gross pay to date, accumulated national savings and so on.

To minimise conversion requirements for the binary 1202 machine which works in binary arithmetic each employee has two cards. The first contains the static information in binary form and the employee's identity number and indicators in decimal form. The second, punched in decimal form, contains all the changing information as well as identify number and indicators—the computer producing a new card every time the payroll is processed.

In addition to conversion from decimal and sterling to binary, adjustments to information are required from time to time. For instance, should an employee want to change his weekly savings towards Premium Bonds, it is not necessary to hand-punch two new decimal cards completely. The computer routine accepts the original binary card and decimal adjustment cards and punches new amended cards. In fact both the original conversion to binary and the amendment are incorporated in a single routine known as the ' adjustment routine '.

This adjustment routine is also used to incorporate supplementary payments made as a result of manual calculations after the computer's production of the previous week's payroll. It also deals with inter-departmental transfers.

During the payroll run for production departments the total gross pay is apportioned to cost centres and budget centre accounts. This information is based on data supplied by the wages department and factory clerks and discrepancies are possible. A pre-payroll scrutiny run has been written to detect and print out the discrepancies.

In the processing of the payroll, various totals are accumulated for agreement with group totals (provided by the wages department), so the individual group payrolls can be processed in any convenient order. Similarly the other routines can be run at convenient times before the main payroll routine provided that the information for a complete group is available and the sequence for a group payroll is always: (a) adjustment routine for supplementary payments, (b) adjustment routine for other adjustments, new entrants, leavers and transfers in and out, (c) scrutiny routine, and (d) payroll routine.

The 1202 has eliminated the delay previously experienced in sorting and summarising the figures for costing and budget control. During the payroll run numerous group control totals are accumulated from the cards, totals are obtained of actual payments and deductions, and amounts under various heads are isolated for labour analysis. Summaries are printed for each group payroll showing all control and other totals.

A card is then punched for each expense account which has been charged and these cards are used as input information to provide weekly and monthly labour analyses. Similar costing summaries show the analyses of labour by budget centre and cost centre accounts.

AFTER PAYROLL

With this routine of payroll and labour costing going smoothly on the 1202 other functions are now going on to the computer. They include sales ledger and stores ledger and possibly some aspects of production control. The original budgeting for the 1202 foresaw a net saving of some £2,000 a year and the company reckons these savings are in fact being realised.

But already the company feel the need for greatly increased office productivity and a vastly greater rate of output. Carreras feel that these objectives can be achieved (with considerable economies) through the use of the ICT 1301 it has ordered to replace the 1202.

For each of the four areas—payroll and labour costing, sales ledger, bought ledger, and production control—a programmer and a systems analyst has been appointed and it is hoped that by the time the 1301 arrives in 1963 the first three areas will be ready to go straight on to the new machine.

The need for a machine like this was apparent since because of slow output speeds, it has been difficult to use the 1202 machine for certain applications—for instance, sales invoicing combined with a smooth flow of despatch documents to the factory—without tying the machine solely to the one task during working hours.

A major factor in the choice of the 1301 was its storage. It has quick access storage of up to 24,000 characters plus magnetic drum stores of 12,000 words or 144,000 characters per drum with a

maximum of eight drums. This will provide the company with plenty of scope for more complicated routines.

At the time of ordering the price of the installation—comprising processor with read/punch unit, high-speed printer and three tape transports—was £119,000. Taking in depreciation over seven years, interest on capital and so on, the accountants calculate an annual saving in excess of £15,000 to be made in avoiding future intakes of clerical staff. At the same time, of course, the work will be carried out with greater speed and accuracy.

THE FUTURE

Naturally before the order was placed detailed studies of its uses were made. Emphasis was on centralisation from the viewpoint of integrating on the 1301 as many departmental functions as possible. Integrated routines were devised for centralised sales accounting, payroll and fully mechanised labour costing, bought ledger and fully mechanised materials costing, and forward production planning.

The sales accounting routine envisages the production of:

1. Invoices (side by side)
2. Sales daybook
3. Cash book
4. Sales ledger
5. Customer action and cash reconciliation list
6. Cycle statements (side by side) with an indication of the type of overdue letter to be sent, where appropriate
7. Non-cycle overdue statements (side by side) with an indication of the type of overdue letter to be sent
8. Orders (side by side)
9. Sales accounting statistics, including:

   daily and monthly brand and pack sales by salesman, depot and region,

   monthly brand and pack sales by type of order within depot and region,

   monthly brand and pack sales by type of outlet within depot and region

   monthly cash analysis by type of collection

   monthly brand sales of 'barometer' accounts

   overdue accounts summary by salesman and region, and

   daily analysis of delivery cycle, showing for each depot the number of days between the date of the order and the date of despatch, and the number of orders in each case.

In this procedure orders are first subjected to vetting to ensure that all details on the order are perfectly clear. Any coding necessary is carried out at this stage. At the same time a similar vetting of cash payments and credits is made.

Cards are prepared as: (a) order card, accommodating customer reference with details of lines and quantities ordered, (b) cash cards showing customer reference and cash paid, and (c) credit cards with customer reference, coded reason for credit, details of lines and quantities returned and the budget applicable.

All cards are sorted to customer code number on a high-speed sorter, this operation and the subsequent run through the computer being carried out at intervals throughout the day.

Cards are placed in the serial card reader of the computer which prints the invoice and despatch documents, taking the name and address from magnetic tape and the brand description and price from the magnetic drum.

In this operation the computer subjects the order to a credit check and posts the customer's sales ledger. From magnetic tape the machine takes brought-forward details, adds total value of invoice, subtracts cash paid or credits and arrives at balance carried forward. It is possible to record the number of days between due date and payment date for the past six cycles which, printed out with the other statement details for query orders, can assist the credit sanction clerk in deciding whether or not to pass the order.

The new debit balance is compared with the credit limit and overdue items are located. In the case of credit irregularities the invoices and packing notes being printed are designated for segregation from those which are without query. A full statement of the account position is printed on the subsequent invoice form for the designated orders and these are passed to the credit sanction department. If the order is stopped an adjustment card is passed through the machine later to credit the customer with the value of the order and to adjust sales analysis and despatch totals.

The factory finished stock position can be maintained on the computer's drum store, receipts into stock being notified during the day and if orders exceed stocks the machine can produce 'to follow' invoices and packing documents.

Despatch and sales analysis information is accumulated for customer and in total for the batch.

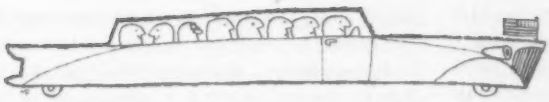
Any amendments to the basic information held on magnetic tape for each customer are punched on designated card and included with the invoicing procedure.

A second daily routine, the statement printing operation, will be carried out using the same magnetic tapes produced by the invoice procedure. This run also serves to clear tape of movement details for the ledger cycle just completed, carrying forward the balance only to the new tape. Any detail required of previous periods can be obtained from microfilmed copy statements.

If selected information for a particular customer not within the cycle were required an inquiry card would be punched and included with the statement printing operation. The information would be printed on the statement stationery. A routine is being devised to give immediate reference to the ledger in the event of urgent telephone and correspondence queries.

THE PUSH BUTTON BANK

It combines a new concept in banking service with a modern approach to data processing—by working in 'real time'



AMERICAN REPORT

from John Diebold and Associates, New York

The banking floor is linked directly to the bank's computer system so that customers who deposit or withdraw money have their amounts and passbooks updated automatically in seconds.

THE expression 'real-time' describes a computer operation that is simultaneous with an event, such as, in the military sphere, controlling and altering the trajectory of a missile in flight.

Until fairly recently, real-time systems had been developed almost solely for military and industrial purposes. The United States Air Defense Command's well known SAGE (Semi-Automatic Ground Environment complex) system uses real time computers to analyse the air situation at any point in time. Summary information from each of 22 input locations is sent to a central computer in Colorado, where findings are tabulated, recorded, and dis-distributed. The Strategic Air Command also uses real-time computing, as does the Signal Corps in the Army European Command.

Industrial process control is also being done by real-time computers in such industries as public utilities, chemical manufacturing, petroleum refining, and iron and steel manufacturing.

In earlier reports* mention has been made of planned developments and new applications of 'real-time' computing in commercial data processing. Now that the reliability of computers is guaranteed 24 hours a day, seven days a week, they are feasible for a constantly increasing number of uses.

The first major commercial installation was in airline reservation systems control. Seat availability, sales, cancellations, and flight data of all types are constantly ascertained and executed by computer. Capabilities now exist for handling the complete passenger record, including the passenger's name and address, and the handling of complete airline logistics problems. A reservation agent needs only to press a few buttons on his agent set (an input-output device to the central computer), and, within a matter of seconds, an accurate up-to-the-moment reply is made by computer.

An operation of this type has been contracted between IBM and American Airlines. IBM's Sabre system is composed of two IBM 7090 computers and associated equipment. The annual rental charge is $5 million, and it is expected that by the end of 1963, all cities in the American Airlines system will have hookups with the central computer.

EXTENDING THE IDEA

One of the most significant new applications of commercial real-time computing is in the field of banking. For example, one of the largest mutual savings banks in the USA has recently purchased a $2 million Univac 490 real-time on-line computing system capable of handling 800,000 accounts—and expandable to handle 2 million accounts. At present the bank has 570,000 accounts.

The bank estimates that savings in operating expenses will pay for the Univac and also give the bank approximately $1,830,000 in ten years. The system† will reduce teller time and clerical costs. Tellers will no longer have to do any filing or card-searching. They will not have to move from the teller window. A great deal of the bank's filing will be completely eliminated. In addition, of course, the speed with which this new system handles transactions will decrease the time depositors wait at tellers' windows, even at dividend and luncheon periods.

In effect, all savings accounting will take place automatically, while the customer is standing at the teller window.

It was first determined that the equipment chosen would have to be an 'on-line' system. That is, one in which the tellers, the processor, and depositors' records are all interconnected by an electric communications system. Transaction information, passbook updating, and account record change are all accomplished at once, with no recording on an intermediate document.

An off-line system would have been less expensive to install and operate, and probably would have achieved savings over present data processing costs: but the off-line system would have little or no effect on banking floor operations.

It would have used the recorded results of depositor transactions as input to a processor and return depositor information to the banking floor for reference and use in transactions. Thus, it

* See American Reports in the January and March, 1961, issues of AUTOMATIC DATA PROCESSING.

† Selection of this system came as a result of an extensive study undertaken by John Diebold and Associates, Inc, retained by the bank as consultants on the project.

would accomplish only part of what the on-line system is capable of doing. The off-line system would have saved on produced savings and been an improvement on the previous card processing system but there would still have been a need for people at each branch to integrate information. It would not have been as current, nor as adequate. No saving at all would have been made on the time for a teller's transaction.

SPECIAL BENEFITS

The important advantages of the on-line system are that (1) it allows depositors to bank at any one of the bank's branches and at any window in the branch; (2) it significantly speeds up the banking transaction, thus making it possible to serve a greater volume of depositors without a proportionate increase in cost; (3) it makes possible completely current savings account activity reporting. An off-line system would have provided none of these advantages.

Equipment proposals were made by IBM, RCA, NCR, and Remington Rand. The selection of equipment was based directly upon adequacy as an on-line savings account system.

Having established that the use of an on-line savings system would give the bank an important competitive advantage in customer service; and that it would also give the bank the system flexibility needed to continue improving customer service and to expand its depositor base without further major systems changes, a group of seven system-selection criteria was set up. The criteria were:

Reliability—the system must work as close to perfectly as possible.

Speed—the system must carry present and future workloads, and improve on the time now necessary to do so.

Expansibility—the system must be able to absorb future growth, with a minimum of expense and disruption.

Flexibility—the system must be adapted to changes in systems requirements because of policy changes or growth.

Manufacturer capabilities—the system must be provided by a manufacturer who can furnish a high quality of service and who will grow with the bank.

Ease of operation—the system must be operated by bank personnel with minimum effort and minimum special requirements.

Cost—the system must be available at a reasonable cost.

All four of the manufacturers met each of these criteria. The decision was based upon which company satisfied the criteria, particularly the most important criteria—*eg.*, reliability, flexibility, speed—with the highest degree of efficiency. The selection of the Remington Rand equipment was also influenced by the fact that the company proposed the only system specifically designed for on-line operations.

AUTOMATIC UPDATING

In the bank's new Univac 490 system a central computer will simultaneously control transactions at teller's windows in each of the bank's five branches. Each teller will use a Univac Unisaver Teller Set, about the size of a typewriter, to transmit deposit and withdrawal information to the computer. The Unisaver uses regular leased-line voice-channel facilities. Up to 4,096 teller sets may be used in a single system.

The Univac 490 ' real time ' computing system supplies facts and results virtually without any loss of time to several points in the bank. For the teller it means he is linked to both a vast file of customer accounts and a calculating machine which produces results instantly. The 490 is an expandable system, but its standard parts comprise central computer, supervisory control panel, remote input-output sets (adaptable to different needs as remote sending and receiving units) a communication control unit, and programmer scanners that control communications between remote locations and the central computer. The system has an internal core store of 32,768 words, and magnetic drum and tape units are available for expanding storage capacity. In the USA the system rents for $20,000 to $40,000 a month. Delivery time: 18 to 24 months.

The Unisavers are similar to the agent sets used by airlines. An amount keyboard is utilised to supply numerical information, *ie.* account numbers, old balance, amounts of deposit and withdrawal, and code numbers. All keys are automatically cleared at the completion of each transaction.

The teller inserts the passbook in the Unisaver, presses the proper keys, and the transaction is electronically transmitted to the centrally located computer, where all records are maintained on high-speed random-access drums.

The computer instantly updates the customer's record and transmits the current transaction, plus any earned dividend since the customer's last visit to the bank, back to the Unisaver. Data travel at a rate of 1,200 bits per second.

When multiple transactions take place, the book is automatically positioned for printing the next entry. The book is ejected from the Unisaver when the last line of information for a transaction has been printed.

Where more than one line is printed, the passbook is repositioned by the Unisaver, which then informs the computer to transmit the next line.

IN CASE OF FAILURE . . .

A journal tape automatically duplicates all bankbook entries. Thus, in the event of computer failure, the teller sets can operate independently. The teller machine calculates the transaction and enters the result in the customer's passbook; it records the transaction on the journal tape, which is reinserted to update the computer as soon as the machine is again in operation.

Reliability is, however, prerequisite to any on-line system. Failures are very rare and usually predictable beforehand. Two servicemen will be permanently posted at the site so those failures which are not foreseen and averted will be taken care of immediately. The overall percentage of reliability of the system is very high—something above 98 per cent. It is difficult to arrive at any exact figure, because most failures are corrected before they ever happen.

The system is capable of handling 50,000 customer transactions per hour. Since only a slight fraction of this capacity will be needed, the machine is programmed to handle various other off-line computing concurrently. In a matter of milliseconds the computer can switch from on-line savings depositing and withdrawal to mortgage accounting, payroll processing, life insurance notices, personnel records, Christmas Club accounting, general expense accounting, consumer loan accounting and processing, or any other banking operation for which it might be programmed.

It is interesting to note that the 30 hours now required to prepare the bank's mortgage notices—a very complex and difficult process—can be decreased by the computer to less than three hours.

The machine will be working constantly at off-line processing. When an on-line inquiry is made by the Unisaver, the computer 'drops whatever it is doing', processes the on-line transaction, and instantly returns to its off-line processing.

Completion of the installation is scheduled for March, 1963.

With the proven reliability of real-time systems, applications are being extended at a rapid rate. The National Cash Register Co has just sold a similar system to another New York bank. The $1,117,000 automated system includes two NCR 315 computers with NCR Class 42 machines at the tellers' windows. Other banking installations are expected in the coming months.

In addition, a number of commercial applications other than banking are being developed.

One large American commercial operation has on order a machine which will analyse and route incoming messages for the entire company. The computer receives every message sent in to the company, and relays it to those persons for whom it is pertinent.

Another system has been rented to a very large company to handle order entry inventory control. Sales clerks will transmit every transaction to the computer, which will record the transaction, take the item out of inventory, and provide up-to-the-second information, thus saving time and expense, while adding considerably to the accuracy of inventory and production control. This system has been rented for approximately $60,000 a month. The buyer has already spent over a million dollars for programming and special research.

A planned application of real-time computing will have the machine doing a digital statistical analysis of large quantities of analog information.

Another application, still in the planning stage, will provide inestimable savings for large mail-order companies and companies with central shipping to many district offices throughout the country. The system will provide real-time routing and shipping control and will be capable of processing some 60 million items per day. The procedure will be similar to that used in banking.

Indicative of the increasing acceptance and interest in real-time processing, is a statement recently made by the president of the above-mentioned bank, regarding the purchase of the Univac 490 system: 'The Univac installation is designed to provide maximum accuracy, and to do it at a substantial saving over present methods. I consider ordering this equipment one of the greatest steps forward that (the bank) has ever taken in depositor benefits and better job opportunities for employees.'

JOB MARKET REPORT

'THINK AGAIN' was the heading of IBM's latest advertisement, designed to attract established men of the £1,750 bracket into the IBM careers; and rethinking and thinking again is being done by all the major computer users in their efforts to attract programmers, operational research men, and O and M analysts, particularly those with experience. The slowing down (or postponing) of some computer projects—a very few—have made the market a little more fluid, but it is still a sellers' market as far as the experienced man is concerned. One company who recently advertised for programmers received 80 applications, but at the end of short-listing it was left with nobody, all the short-listed applicants having taken jobs elsewhere in the interim. Happily, the story does not end there; the company re-advertised, and received four applications all with good potential, and the company are making its selection again, fast!

The computer manufacturers who bear the brunt of training, both for their own people and for their customers, are already expanding their training facilities. Elliotts, NCR and IBM, were in the market last month for education officers, instructors and lecturers. The job specification put out by IBM, was for a graduate (or equivalent mental aptitude) under 30, with the ability to communicate ideas, who will have the job of teaching the principles of a wide range of data processing equipment. Provided the candidate has these qualifications, and a liking for logical analysis, prior knowledge of computerology is not required, though such experience would make the applicant even more acceptable. Thus it seems that the companies are willing to teach even their teachers.

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Experienced programmers are of two categories, programmers required for commercial projects —in most cases for a computer not yet installed—and programmers to work on research and advanced system development problems. Into the former category would come programmers required for the Scottish Coal Board's AEI 1010—with ability to lead, train, and direct; for Mullards, where the programmer, experienced in systems investigation, is required to program a 1401 in administrative and accounting work; for Templeborough Rolling Mills (where a production control system is projected for a computer with magnetic tapes; and for both Hunting Aircraft and an unnamed oil company (Esso Ireland?) planning for a 1301. Research programmers, interested in logical system design, were required by the Ferranti computer centre for statistical work and survey analysis connected with Orion and Atlas computers; by the Nuclear

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The salary specified by CEGB —£900–£1,500—seems to suggest that the salary range for OR men may be widening at the lower end; until now they have been found in the £1,750–£2,200 only. Possibly this suggests that a secondary grade of OR man is being created, in the 25–30 age bracket, of graduates with a degree in mathematics or statistics, but without a heavy backlog of high powered experience to push his market value to the £2,000 plus mark.

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A special ADP investigation

HANDY COMPUTERS COMPARED

R M Paine

SEVERAL small computers, which fit quite easily into a small office and in most cases look just like an office desk, were on show recently at either the Electronic Computer Exhibition or the Business Efficiency Exhibition. Three of these machines in what we may call the 'handy' size in contrast with their cousins in the 'jumbo' or 'giant economy' package, were new, and it is a useful exercise to attempt to compare these three new machines—the Monrobot Mark XI, the CE 102 and the Clary DE 60—with an existing and familiar machine of slightly bigger capacity—the Ferranti Sirius. All of these machines in their basic form are sold for less than £20,000, but it is not, of course, suggested that they are of the same type or can be used for the same applications.

Monroe Calculating Machine Co are now selling in this country the Monrobot Mark XI Computer which was developed in the USA. This machine is designed mainly for commercial work but can be used for mathematical or engineering calculations.

There can be up to three input units and up to three output units which is unusual on a small machine but which is useful for commercial applications requiring file up-dating and printed output. On the basic machine, priced at about £12,500 there is one paper tape reader, one paper tape punch, and one typewriter which is used for both input and output. Another possible combination is to have an extra typewriter for input and output, and a second paper tape reader, and this would sell for around £15,000. Punched card readers and punches can be fitted if required but these must not be confused with the normal punched card equipment fitted to large computers. With the Monrobot the machines used by IBM punched card operators—the IBM 024 or 026—are fitted; one 024 acting either as a reader or a punch. This is because the high speed of other more expensive card readers could not be used to advantage. If the basic machine had two 024's added—one for input, one for output—the total cost would be around £14,500.

The Clary DE 60, marketed in this country by Block and Anderson Ltd, is really only an extension of a desk calculator to perform a larger number of steps than would be convenient to set up on a calculator keyboard by hand. It has no paper tape or punched card input and the only method of input of data is by hand. Obviously the amount of data that could be so entered is rather limited and the speed of entry governs the speed of the machine—it is doubtful if the Clary DE60 would be used for working with a large number of variables. The single method of output is by a Smith-Corona Marchant typewriter, and since the machine does not handle alphabetical data internally, all headings for output have to be typed manually. The price for the basic machine seems rather high at about £11,200.

The CE 102, a new small computer made by a British firm, Computer Engineering Ltd, of Bracknell, Berkshire, was one of the big surprises of the Electronic Computer Exhibition. From all the published details and its price—around £9,000—it seems superior to the small computers offered from the USA, and it will be interesting to see how quickly it is put to use in technical colleges and small firms in this country.

The CE 102 is based on the machine NHECTA I developed at the North Hertfordshire College of Technology and is specially designed for technical college laboratories, research centres and small industrial concerns. It has been designed with the aim of teaching students, and therefore, it is claimed that programming is simple and easy to follow. It is also stated that reliability is high since it was realised that the computer would have to give long periods of trouble-free running without expert engin-

eering attention, and be subject to some mal-use.

The Ferranti Sirius computer which, as stated above, I am using as a kind of yardstick for the purposes on this report, looks the least like an office desk and more like a traditional computer. It is a general purpose machine with paper tape input and output as standard, and the possibility of adding punched card equipment. It can have ten input and ten output channels and is generally larger and faster than the other three machines and, therefore, it is not surprising to find that its price is also higher at £18,450 for the basic system.

INPUT AND OUTPUT

The paper tape reading and punching speed of the Monrobot is 20 characters a second, and the typewriter output speed is 10 characters a second. Punched cards—if used—are read and punched a column at a time at the speed of 16 columns per second—thus for fully punched 80 column cards the rate is 12 cards per minute. This is slow compared to larger machines but in harmony with the speed of the rest of the machine.

The method of data input on the Clary, as mentioned above, is by hand only. The address of the location is first set up on the keyboard, and then the number to be placed in that location is keyed in. The insertion of instructions to the machine is dealt with in a later paragraph. The typewriter output like that of the Monrobot gives a good, clear print at about 12 characters a second, but there is no provision for carried forward data, so the Clary DE 60 seems more suitable for one-off jobs than jobs requiring the output of one week to be the input for the next week.

The input/output equipment of the CE 102 is fairly simple with one Creed 5-hole paper tape reader operating at 25 characters a second, and one Creed teleprinter operating at seven characters a second and a paper tape punch. Faster paper tape readers, punchers and printers can be used instead of or in addition to this standard equipment for a modest increase in price. It is not planned at the moment to add punched card equipment.

Sirius has by far the fastest and most versatile input/output equipment of the four machines. The paper tape reader operates at 250 characters per second and the output punch of 60 characters or 110 characters per second. With 80-column card equipment, which would increase the price by about £10,000–£12,000, the reading and punching speed is 120 cards a minute; it is not expected, however, that many installations will use punched cards. That is to say that on the basic machine input is about ten times, and output four times, as fast as any of the other three machines, for about twice the price. In addition full use of the many input/output channels of Sirius can be made in process-control or data-logging applications, for which the other machines are not suitable. NEP magnetic tape at a slow speed may be added to help in this type of work, for about £6,000 a unit.

CAPACITY

In the Monrobot machine data and instructions are stored on a magnetic drum holding 1,024 words each of 32 bits, equivalent to nine decimal digits or five alphanumeric characters. This is a useful sized store for a small machine at this price. The drum speed is 5,200 revolutions per minute with the maximum access time $11\frac{3}{4}$ milliseconds, and the average six milliseconds. Seven of the words on the drum have special circuits to allow them to be used as a fast access store and are used for accumulators, multiplier registers, etc.

The data storage of the Clary is on a small magnetic drum with 16 locations per channel and the machine is sold with from two to 10 channels, but some of these locations are reserved for working accumulators, multiplier registers, etc, so that the maximum effective data storage is 100 words. Each word can hold 18 decimal digits and a sign, and is considered to be a fixed point decimal integer with the decimal point to the right of the word. The circuitry is transistorised and the machine is certainly compact. Maximum storage would add about £4,000 to the price, so on grounds of capacity and price the DE 60 seems to compare unfavourably with the other three machines.

There is no doubt that the CE 102 is a computer rather than a calculator with good desk appeal. It has a magnetic drum holding 4,060 binary words of 32 digits each, very large for a machine of this price. The drum speed is 6,000 rpm with maximum access time 10 milliseconds and average access five milliseconds. Each word can hold the equivalent of an eight digit decimal number plus sign, or six alphanumeric characters.

There is a fast ' wired ' store of 32 words which contains the accumulator, the multiplier register, the input register, the output register and certain constants useful for programming, but is not used as a fast store.

Sirius does not use a drum for storage but delay-lines with a maximum access time of four milliseconds. In the basic machine there are 1,000 words of 40 bits each equivalent to 10 decimal digits—this is less than is provided in the CE 102. Sirius can, however, have its storage extended up to 10,000 words; and to increase it by 3,000 words costs about £7,000 extra, and most purchasers have ordered a total of 4,000 words. In addition there are eight words of working store in fast access lines which are used as accumulators—more accumulators than the other three machines put together—and this feature eases programming and increases speed. One would expect, of course, more refinement in a machine whose price is double that of the CE 102 –but the user must decide whether that refinement is worth the cost.

SPEED AND PROGRAMMING

In the Monrobot Mark XI two 16-bit single address instructions can be stored in a word, and the instructions are obeyed sequentially from the drum. This means that at least average access time has to be allowed to obtain each pair of instructions, and instructions cannot be placed

around the drum in such a way as to reduce access time. To add A to B and place the result in C requires three instructions, and unless the operands are in the fast store, at the start of the routine, it requires three accesses to the drum to obtain the data. Addition time is three milliseconds and multiplication is 28 milliseconds, but these do not allow for access to data or instructions so that to perform A + B = C might take between 10 and 40 milliseconds. There are no index registers, nor a normal division instruction though division by 10 is provided and the ' Detract ' order makes programmed division quite easy. The multiplication instructions gives a double length answer, and a multiply by 10 order is useful for input and output conversions. Floating point operations are not provided but can be programmed. There are no buffers in the usual computer sense, and one character is read to the accumulator on each input command where it is tested and checked and used to build up the incoming number. There is a parity check on input and output, but not on internal transfers or arithmetic. At present there is no autocode in the sense of Fortran or Cobol, but there is a Symbolic Assembly Program which simplifies programming a little by allowing mnemonics for instructions and 4-digit names for addresses.

The DE 60 is programmed by means of wiring on a plugboard and is limited to 120 single address steps —thus to add A to B and store the result in C would take up three of these steps. If required, some of these steps can be used for sub-routines which can be called in the main program. Thus a square root sub-routine and a main routine could share the 120 steps using about 25 steps for the square root routine. One can also enter instructions from the keyboard—this would probably be used for a small calculation which it was not worth plugging, and obey the wired sub-routine by pressing a special switch on the keyboard. This wired plugboard means that the machine is obviously much more limited than the other three computers.

The plugboard unit is called the ' programmer ', hence the startling announcement in the Clary brochure that the machine weighs 135 pounds ' including the programmer '!

The order code is simple and includes multiplication, division and jumps but there are no index registers to allow modification. There is no parity check on transfers or arithmetic, there is no provision for double length answers or floating point, and the machine stops on overflow. Addition takes 3.9 milliseconds plus access time, and an average multiplication might take about 50 milliseconds plus access time. But as noted above data insertion and typing will occupy most of the time. It is probably the easiest of the machines for an untrained operator to use.

In the intriguing CE 102 each word can hold a single address instruction, and since these instructions are obeyed sequentially from the drum the access time has to be taken in account in order to obtain them.

The word time is 340 microseconds, and the addition time is fast for a small machine at about 680 microseconds plus access time. Multiplication with a double length product requires only about 10 milliseconds plus access time. Division is by program in the standard machine but could be built in for an extra £500 or so. To add A to B and put the result in C would required from about four to 40 milliseconds, including access to data and instructions, which is better on average than the Monrobot.

The order code of 13 instructions includes the normal arithmetic and transfer instructions and in addition jumps, shifts and logical ' and '. There is no built-in floating point operation.

There is a digit in each instruction which can be used for address modification. This is carried out by adding the number in the multiplier register to the address of the instruction, thus forming a new address, and then the instruction is obeyed; the stored instruction remains unaltered. All drum addresses can be so modified. In its original design this facility was present to show students how modification worked rather than being useful in itself. But with the commercial interest being shown in the CE 102 the makers are planning to add one special index register which will be more convenient to use than the multiplier register. This might increase the price by about £500 but would certainly give a powerful order code to a small computer, and I am very pleased to see this facility in the CE 102.

The Ferranti Sirius has an operating speed in many respects comparable to the larger Pegasus computer. The addition of two numbers already in the accumulators requires only 240 microsecs, and if the numbers are in the main store an average of 2 milliseconds must be allowed for access. Multiplication and division require an average of about eight milliseconds plus access time if necessary. There is one instruction per word as in the CE 102, but two addresses can be specified in the instruction—one of which is a main store address, and the other, one of the accumulators. This means that to add A to B and place the result in C need only take two instructions. Thus it is possible to require less program steps and to obey them quicker so that the range for the calculation A + B = C is probably from about a half to 17 milliseconds including access time to data and instructions. Ferranti claim that in Sirius only about 10 percent of instructions require reference to store and about 5 percent are for multiplication or division. This means that about 1,000 instructions could be obeyed in a second on average, or that each instruction takes an average of only one millisecond. This is far faster than the other machines, and shows how much timing depends on the order code, number of accumulators, modification facility, access time, etc, and should not be taken straight from a quoted add time.

Sirius has on order code of over 60 instructions—by far the largest of the machines discussed in this article—though of course the other machines can do their work quite adequately with fewer commands. There is no

built-in floating point though it can be programmed; multiplication provides a double-length product and there is built-in division. There are no buffers and input and output cannot be carried out at the same time.

All the accumulators can act as index registers, so Sirius has very good modification facilities compared to the other three computers, which help in ease of programming and speed of operation. All input, output and internal transfer operations are checked for parity—and this is the only machine of the four in which this is done, though again one is paying for this extra precaution.

Sirius uses the same autocode as Pegasus which greatly extends the use of Sirius to non-professional programmers. There are two stages for the Ferranti Autocode on Sirius, first the compiling and punching of the object program, and then the re-input of the object program, the reading of sub-routines and the running of the job. Autocode programs are said to operate at about twice as fast on Sirius as they do on Pegasus.

MAINTENANCE

All of these machines are similar from the maintenance aspect in that they are much simpler to maintain than the larger computers and an engineer is not required on site, and daily or weekly preventative maintenance is not necessary. For the Monrobot and the DE 60 especially, maintenance will be planned as if for a typewriter rather than a traditional computer—and this is surely encouraging news to users.

The reliability of the Monrobot seems very good—it was flown over here from America, and plugged in and it worked; it was then moved to the BEE, plugged in and it worked. Western Electric in America report that without scheduled maintenance, down time was only 1·1 percent out of 581 hours during a four-month period.

APPLICATIONS

Most of the enquiries for the Monrobot at the BEE were for commercial applications, but technical users might have been interested if the computer had been shown at the Electronic Computer Exhibition. An example is quoted of a 6-line payroll produced at a rate of 100 men an hour (36 seconds a man) where the bonus side had been calculated prior to the run on the Mark XI, but the computer covered overtime, tax, national insurance, cash analysis, etc, and also produced departmental totals and cost centre totals and punched carried forward data. The program required 1,800 instructions or 900 words, so little room was left for such things as departmental totals. The ability of the machine to cope with alphabetical data is very useful on such jobs as payroll. The speed is obviously not very startling and punched card calculators can probably do a similar job faster, but at a slightly increased cost.

The claim that the DE 60 is a computer is probably based on its stored program and data memory—but as shown on investigation these seem really to place it in the electronic calculator class.

It is mainly designed for general mathematical and engineering calculations, and the provision of castors on one of the models is obviously intended for a trolley service to any office in the building which suddenly requires to do some calculation too long to perform comfortably on a desk calculator. For this purpose the machine seems useful if costly—' instant calculation ' at your elbow. As an example of some of its abilities, the Clary DE 60 can solve for the roots of a quadratic equation,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$ in 20 steps

plus the square root subroutine of about another 25 steps. It can calculate the stress and deflection of a beam of any cross section in 5.62 seconds per iteration or output line (including input, calculation and output). For a very simple payroll with no piece-work or bonuses it takes about 20–25 seconds per person including input and output but no carried forward data, and the program occupies 55 steps.

The CE 102 is very suitable for technical calculations and for training our next generation of engineers, scientists and managers. It could also be used for commercial jobs where there is little printing to do and where control of vital information is more important than pages of reports. Such has been the interest aroused by the showing of the CE 102 at the Electronic Computer Exhibition that the makers are thinking of negotiating an arrangement with a larger firm that has an experienced sales force in order to market the machine properly and follow up all enquiries. It seems that Computer Engineering have more a problem in production than in sales in order to be able to make the machines that will be ordered.

Sirius is suitable for many types of application but is especially useful for technical calculations with a medium amount of input data, and with extra input-output equipment for data-logging and limited process-control work. Commercial work can be performed on the machine provided there is no real need for vast amounts of output printing or a great deal of sorting. It is understood that about 20 machines have been installed or are on order, that the average price per order is from £25,000 to £30,000, and that about a third of the orders are for commercial work, such as stock control or bonus incentive calculations.

THE OPPORTUNITIES

It is significant to see the computer industry expanding at both ends of the scale say (from Atlas to the CE 102), and here we have concentrated on the small machines. The British machines come out very well from the comparisons made and it is hoped that they are marketed with as much force and skill as is normally given to American machines. The small user must be pleased as he now surveys the field since he can either buy a small computer of useful power or hire time on a very large machine. Either way it seems that computers need no longer be considered the preserve of the big boys.

KEEPING THE INSTALLATION RUNNING SMOOTHLY

J W Mitchell

First steps are to standardise on methods to give clear guidance as to how various jobs should be done

IN any electronic data processing installation, it is necessary in the early stages to spend a considerable amount of time in establishing procedures and approaches to protect the work which is to be processed through the system. Frequently, far too little attention is paid to this subject. It is allowed to grow in random directions, according to the varying whims of the personnel employed at various times and places.

These procedures and approaches are mainly connected with getting work onto a computer installation and seeing that the installation runs smoothly. In certain matters, the procedures or methods employed must vary according to the requirements of the individual installation, but in others, it could prove quite feasible to establish national standards. For instance, nearly every programmer has his own system, covering flowcharting, annotation of charts, etc, yet think how much easier it would be if standard procedures were laid down, and all charts conformed to one system. The purpose of this article is to indicate some of the more important areas for the establishment of standardised procedures as a general guide for the user. It is not intended to lay down specific standards of any sort, but to indicate that standard procedures are essential if companies that operate computers want to avoid chaos.

Clearly, standard installation procedures must be established at an early stage if only to avoid having to redraft work that does not conform with such standards. No systems study or programming should be commenced until such time as basic procedures have been decided. However, no matter how carefully this initial planning is carried out it will inevitably be found at a later stage that amendments, or additions to the procedures are necessary. The planning should therefore be carried out in such a way that modifications can be incorporated without requiring to alter all existing work to allow for this.

There are four main areas where establishing procedures and methods is, if not essential, of great value:

1. Terminology.
2. Programming.
3. Operator, and engineering procedures.
4. Internal programming routines.

It is worth examining each of these areas further, and illustrating with a few of the many points to be considered in each. This may well stimulate thought as to how improvements can be achieved in control at little cost.

TERMINOLOGY

In addition, when establishing terminology it is essential to bear in mind the necessity for distinguishing between procedures existing prior to the centralisation and integration of processing and the revised procedures introduced with the computer system. This is essential in order to avoid confusion between the varying records kept on the two systems. Different terminology may well be employed, with the glossary so arranged as to cross reference the two sets of records. Thus, for example, on the manual system one can have a ' sales ledger ', and on a computer system refer to it as the ' debtors file ', thus adequately distinguishing the two forms in which the records are kept. For clarity of understanding each term must be defined, and its correct usage established.

It is essential at an early stage to achieve complete standardisation in the vocabulary to be employed in any data processing system. The use of technical terms in any organisation is inevitable, but can and does lead to misunderstanding, even amongst the *cognoscenti*. A well established glossary can do much to prevent this. There are two main areas where a glossary should be established: (1) a glossary of terms in general data processing and accounting usage; and (2) a glossary of technical terms, peculiar to the individual organisation.

The first requirement has largely been met by the *Glossary of Terms Used in Automatic Data Processing*.* This contains some 1,200 terms in common usage in the fields of accountancy, data processing and electronic computing. Whilst the adoption of these definitions as a standard throughout the data processing field would be of considerable benefit to all manufacturers and users of data processing equipment, this unfortunately has yet to be achieved. (For instance, one leading British computer manufacturer uses the word ' processor ', both in its normal sense as a unit of ' hardware ', and also to mean an autocoding program, of the class normally known as a ' compiler '. This leads to confusion in the manufacturer's literature which could be avoided if the term ' compiler ' were used.

A glossary of terms peculiar to an individual organisation is an obvious requirement. Each field of business activity has its own jargon, which is used and accepted by all persons in that field. Here its usage is well accepted, so that the necessity for a glossary can be overlooked, yet the usage of these terms can well lead to abuse, and create difficulties in a large group with many subsidiaries, so that it is as well to establish at an early stage the meaning of each term, and to establish definitions for use by the EDP section.

PROGRAMMING

The importance of a uniform system of programming cannot be over emphasised. At present there is no nationally adopted approach to the programming problem. Even though this is an extremely complex field, a modicum of standardisation can still be introduced in certain aspects. It would seem feasible to introduce standard procedures in many areas which could then be adapted to the individual requirements of each user's system. For instance, in the same way that ASME have drawn up a series of standard symbols for work study charting, it should be possible to introduce a series of standard symbols for program flow charting. Perhaps the ACM, or the British Computer Society, could take a lead in this direction to produce a recognised standard procedure for charting. This would render flow charts more intelligible to outsiders, and enable programming to be taught as a specific subject. Naturally machine coding courses would still be required, at least temporarily, though it is hoped that eventually one set course in programming, and the use of some facility language like COBOL will enable programmers to work on any machine. This is within the bounds of possibility, and would considerably ease the staff training problem.

Two obvious spheres where standards should be introduced when establishing a computer system are:

(a) Work study and charting symbols.
(b) Program records.

Here it is only intended to briefly cover the points involved, as the whole subject has been dealt with in considerably greater detail.†

The various types of chart to be prepared, and for which standards must be introduced, are enumerated below. The standards must cover:

(a) The symbols to be employed.
(b) Recognised abbreviations.
(c) The use of codes—subscripts and superscripts.
(d) The provision of glossaries of codes, etc, as an appendix to all charts and working papers.

* Published by Business Publications Ltd. This Glossary is currently being revised and a second edition will appear early next year.

† See 'Program Layout and Presentation': AUTOMATIC DATA PROCESSING, Nov. 1959.

(e) The system of cross referencing charts, programs and reports to be employed. Detailed cross referencing is essential for revising work at a future date.)

The main classifications of chart which will be employed in analysing a data processing problem, and in programming the solution, are as follows:

Systems Chart

This is a breakdown of the data flow through the existing system, and is used in conjunction with floor plans, string diagrams, etc. Standard methods of charting are well established (ref Organisation and Methods, Millward) and the ASME charting symbols have been accorded almost universal acceptance for this work, possibly subject to local variations.

Some Typical Symbols

In analysing a data processing problem this type of chart has two main uses:

1. To illustrate the manual or mechanised system presently used as a series of operations.
2. To show the flow of data under the computer system, external to the computer itself. Thus illustrating the manual handling of data, and the information checking still required.

The Data Analysis Chart

This is a graphical breakdown of all data handled, analysed into their various categories, showing size and the flow of information from document to document. The problems of handling information are in establishing its natural flow, and in eliminating unnecessary detail. It will be found that all documents (the ' word ' document is used here in its broadest sense to cover any media containing information) fall into one of four basic categories: *input media; master files; intermediate records;* and *output media.*

The objective of electronic data processing is to proceed from the input media, automatically maintain master files, and provide output media at the same time eliminating all intermediate records. As a subsidiary operation, it is usual to restrict output to essential information in its most useful form, reduce reference to master files to the absolute minimum employing the principles of management by exception, and the automatic generation of exception reports. Ideally intermediate records should be completely eliminated, but in view of the expense of data processing and its speed of operation, it is more economic to retain some of them albeit in magnetic tape form.

There are however two basic rules in data analysis which should always be remembered: all information must have a source; and if information is not required in some form for output, it is unnecessary.

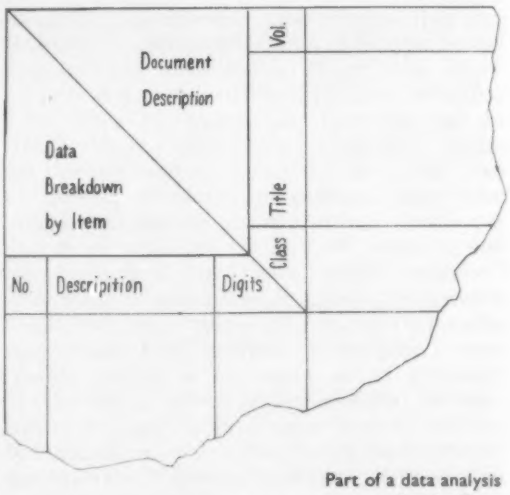
The data analysis chart consists of a graphical presentation of the contents of all documents employed in a system (see opposite). Individual items of information are enumerated on the vertical axis, and the various documents are listed horizontally across the chart, commencing with the input media and terminating with the various output media. Having listed every single item of information, and every record, the grid can be filled in by marking under each document the items which it contains. Thus providing a complete breakdown of the information within the system. Having analysed all documents on this chart, it is possible to tell if any documents have been omitted, if any of the information provided is unnecessary, or if there is any duplication of records.

The Data Transference Chart

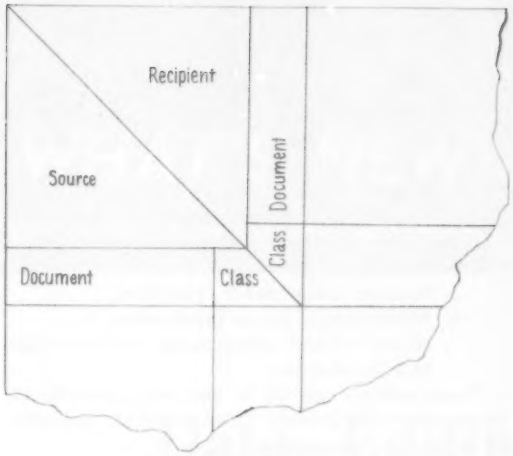
This is a smaller chart which is prepared to show the movement of information from one document to another (still using the term ' document ' in its broadest sense). The volume of data is ignored, and only the work flow is illustrated in order to demonstrate how integration can best be achieved.

For this chart the documents are arranged as three groups: input media; master files; and output media.

The input media are listed on the vertical axis of the chart (see opposite), followed by the master files, and on the horizontal axis the master files are listed, followed by the output records. A mark is made on the grid at every point where information is transferred from a document listed on the vertical axis to one listed horizontally.



Part of a data analysis charting form



Part of a data transference chart

By eliminating the intermediate records in this chart, one can see how source documents effectively update the master files, and what is the source of the output data, thus effectively indicating which actions can be amalgamated. By studying this type of chart it is possible to ascertain:

i. How to complete the maximum amount of updating in a single process from the given input.

ii. How to maintain the maximum information with the minimum number of files and records.

iii. How to obtain the maximum output information with the minimum amount of processing.

The unfortunately as yet unobtainable objective is to have a computer with one program, containing one master file, possibly in random access. To update this file with all input data as a single process, at the same time extracting all the necessary output. Whilst this degree of integration is unlikely to be achieved, study of charts of this nature may well point the way to minimising the number of programs involved.

The Block Diagram

This is a chart prepared to indicate the data flow from computer run to computer run throughout the system. It also indicates the source data and output information, and also gives details of information transfer by means of magnetic tapes, etc. The blocks are chosen in such a way as to illustrate the various media involved, and annotated so as to reference the various files, programs, etc. In addition to the various references, the blocks will contain the title of the program, files, etc. Different shaped outlines are used to illustrate the various types of record.

Process Chart

This chart is prepared to illustrate the processes to which the data are subjected during the course of the computer operation in general terms. This indicates clearly, in plain language, how the processing is completed.

Flow Chart

In this chart the program is broken down into its constituent steps in the greatest possible detail. It is from this chart that the autocodes are written, or the machine coding completed.

These latter three charts have been mentioned to emphasise the necessity for introducing standard procedures. It is considered that most readers will be aware of these various types of chart and their functions in general terms, and that it is not necessary therefore to go into great details in this direction. The standard types of box, that can be used, have already been amply covered in a previous article (see the November, 1959, issue of AUTOMATIC DATA PROCESSING), together with the uses of the various types of chart. In the absence of any standard procedures in this area, it is felt that users should establish their own procedures to be employed on all charts, and should circulate these as a part of their internal glossary.

OPERATOR AND ENGINEERING PROCEDURES

Programmers in an installation will prepare complete operating instructions for each routine, and supply these to the operators and control staff. Obviously a considerable amount of information must be included in the program manual in order to inform the operator of the correct settings and sequences for each routine. In order to facilitate operations, it is best that a standard sequence for the information should be established, and that the information be laid out in a standard format. The predetermined standards may well be established by the manufacturer of the equipment, so that all programmers trained on the equipment set out their instructions in the same way, and that any operator can pick up any set of instructions, and by following it process the routine correctly.

It is obviously impractical to prepare national standards which will cater for all equipment, but it can be done for each machine. Failing the establishment of a system by the machine manufacturer it becomes essential for each user to establish his own standard procedures and operators'

instruction format. He must also train all his staff to recognise and use his system. The following information should be included in the instructions:

1. The equipment to be used.
2. The allocation of peripheral units.
3. The correct settings for all switches and controls.
4. Information to be keyed in.
5. Breakpoints, controlled outputs, and action to be taken. (The computer could, of course, be programmed to print these instructions, but that is rather time consuming.)
6. Types of inquiry and reply available.

The Engineering Staff will be trained in their correct procedures for faulty tracing and rectification, so it but remains to consider any records of performance which should be maintained. There are two basic records, the maintenance of which should be made the specific responsibility of one member of the control room staff, who must be kept supplied with the requisite information.

Machine usage planning records. These consist of a series of time booking sheets which record the planned usage for all equipment, the purpose of the booked time, time reserved for preventive maintenance, etc. It is necessary to ensure that adequate time is allowed for testing programs, debugging, and other non-productive routines. Also arrangements must be made for routines exceeding their allotted time, or conversely being completed in less, both of which require a re-allotment of time.

The Machine Performance Records. This consists of a series of log sheets for each piece of equipment, on which its history is recorded. These sheets will detail:

1. Planned usage.
2. Planned routine maintenance.
3. Achieved usage by class of processing.
4. Idle time.
5. Routine maintenance completed.
6. Maintenance due to breakdowns.
7. Abortive time, reprocessing necessary due to a breakdown.

These records can all be analysed, possibly on the computer, to provide a measure of the efficiency of each unit of equipment.

A record should similarly be kept of each reel of magnetic tape, showing its history. The following details being contained on the log sheet for each period of usage:

1. Program on which the tape was written.
2. Number of bad patches detected, and blocks wasted.
3. The date on which it was written.
4. The programs on which the tape was read.
5. The dates on which the tape was read, and any failure to read.
6. Any special remarks about its condition, etc.

PROGRAMMED HOUSEKEEPING ROUTINES

As part of a policy for ensuring the smooth running of an installation, certain checking routines must be built into every computer program. For instance, all inputs must be checked for accuracy, punched cards should contain a card category code which the program can check to ensure that it is the correct input for the program, and to identify the class of data. This code must be punched into the same position on all cards, not a different one for each input routine. Input routines should total and check all inputs against 'hash summary totals', prepared externally, and fed in with each batch of cards, to prove that all input has been correctly received and interpreted by the computer. At the same time, proof totals can be printed out, together with queries about any discrepancies.

In the case of magnetic tapes additional security checks are required, these can take the form of a standard checking routine which is built into every program, and which checks every magnetic tape before allowing any reading or writing of data to occur. This routine must check:

(a) That the correct input tapes have been provided.

(b) That writing has been inhibited on input tapes.

(c) That the output tapes do not contain live information required on a further routine, and may safely be used.

(d) That the tapes are attached to the correct decks. (The program could be arranged to allot the decks to itself, according to the files they contain.)

(e) To inform the operator of errors, and the necessity to change tapes, etc.

Before commencing any electronic data processing activities a considerable amount of thought must be given to these basic 'housekeeping' requirements. Effective control procedures must be developed, for both internal program use, and external data control. There are inherent dangers in overlooking any of these points, the main one being that if at a later stage it proves necessary to introduce any additional features it may be necessary also to go back and alter every routine which has been developed up to this point to cater for them.

Data Editing Computer

Able to determine own scanning patterns

A SMALL low cost digital computer, the KDN 2, has been developed by English Electric, primarily for industrial and process control, but also as a data editing subsidiary of a larger computer.

Data editing would embrace the conversion and editing of raw data from peripheral units, taking data from low speed input sources, such as card or paper tape readers, and transferring to higher speed media, such as magnetic tape, etc; or reversing the process and transferring magnetic tape to output printers, tape or card punches. Scientific applications of the KDN 2 include the sequential scanning of factors in process control on a purely cyclic basis, allowing the computer in fact to determine its own scanning patterns as a result of previously processed data.

The KDN 2 has a high-speed ferrite-core store, built up in units of 512 18-bit words to give a maximum capacity of 4,096 words. With the addition of buffer facilities, the KDN 2 can be made to control standard magnetic tape units which could serve as backing store.

Input is normally in the form of paper tape processed at 20 codes per second—5, 6, 7, or 8 channel tape can be specified. Data input is subject to parity check. Output is similarly punched into 5, 6, 7, or 8 channel paper tape at a speed of 20 codes per second. Printed output on an electric typewriter is at the standard 10 characters per second.

Optional extras for real time applications can be provided, together with analogue-digital and digital-analogue converters. Random number generators and photo-electric measuring devices can be coupled into the system without special conversions.

The order code specifies 64 functions allowing automatic instruction modification to give single or double word-length working, that, is 18 or 36 bit words. The 18 bit word is divided into three groups of six bits each. The most significant group specifies the function and the other two specify the address in the main store. The automatic multiplier gives a double-length unrounded product, and the automatic divider accepts a double-length dividend and a single length divisor and produces a single-length quotient.

The cost of the KDN 2 is given as approximately £20,800.

For further details tick L01 on the reader enquiry coupon on page 41, or write to:
English Electric Co Ltd,
English Electric House,
Strand, WC2.

The KDN 2 in English Electric's Data Processing Centre at Kidsgrove, Staffordshire

Microfilm Search Library

BASED on their successful high speed paper tape searching system, Ferranti Packard, the Canadian associates of Ferranti, have developed the Rapid Look-up System. This method allows catalogued records to

be stored on a continuous loop of 16 mm microfilm, each frame of the film—which would contain one document—being allocated a binary address code.

When it is required to find a particular record the operator will depress keys on a keyboard which relates to the initial three letters of the item. The film will then be read at high speed until the address code of the required frame is recognised by the machine. The machine then stops and the frame appears, suitably magnified in the eye level screen.

Documents on the wide screen

Access time for any particular frame must depend on its position on the microfilm loop—the longer the loop, the greater the access time, but the makers reckon that on an 880 page catalogue the access time would be approximately three seconds; 440 pages approximately 1.5 seconds; 220 pages approximately 0.75 seconds, etc. Searching time of the file loop is 40 inches per second, and the start/stop time is 0.02 seconds.

Catalogue amendments could be carried out at periodic intervals by re-processing the entire film loop. This would be done by means of an ancillary filming unit, which would produce the negatives complete with address code; the code would be set up on a three bank alphabetic matrix on the unit control panel. The negatives could be processed commercially to give ordinary microfilm positives.

For further details tick L02 on the reader enquiry coupon on page 41, or write to:

Ferranti Ltd,
21 Portland Place,
London, W1.

High Speed Card Reader

DESIGNED for use as input to the NCR 315 computer, but able to be used with other equipments, is the Model 380 card reader, which is able to read 80 column cards photo-electrically at speeds up to 2,000 cards per minute.

Cards are loaded on to the input hopper, which has a capacity of 5,000 cards, and feed through the reader either continuously, in batches or 'single shotted'; a mechanism ensures that only one card is fed through the reader at one time. The reader can be programmed to read all the 80 columns or only a single field, as required.

Two photo-electric reader units permit the comparison of two separate card readings, and there is also an 'echo check' between the reader and the computer to ensure that no code had been dropped during transmission. All transmissions are checked for parity and a first-and-last column check makes certain that the card has been completely scanned. After scanning the cards are fed to the output stacker which holds up to 5,000 cards.

For further details tick L03 on the reader enquiry coupon on page 41, or write to:

National Cash Register Co Ltd,
206–216 Marylebone Road,
London, NW1.

Dielectric reader defies dirt

A TAPE reader which uses a dielectric as opposed to a photo-electric method of reading is being marketed by AEI Ltd. The advantage of this method, say the Swedish designers, Facit AB, is that performance of the reader is not affected by light, dust or dirt, nor are the components subject to ageing.

The reader, the AEI Facit Model ETR 500, operates at 500 codes per second, irrespective of whether 5-, 6-, 7- or 8-channel tape is used. The read head can be adjusted to take 5- to 8-channel tape. The stopping distance of the machine is 0.01 inches, the reader stopping in one code after the stop impulse (counting 10 codes to the inch).

No sterling price for the ETR 500 has yet been specified, but it is expected that it will be competitive with the Ferranti and Elliott high speed readers.

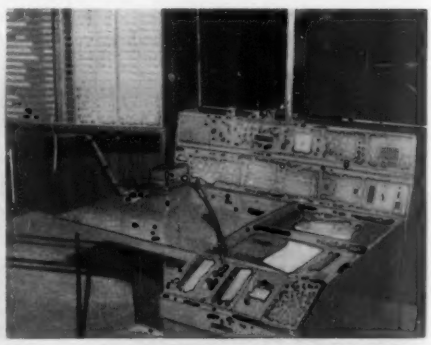
For further information tick L04 on the reader enquiry coupon on page 41, or write to:

AEI Ltd,
Crown House,
Aldwych,
London, WC2.

Data Transmission Reader

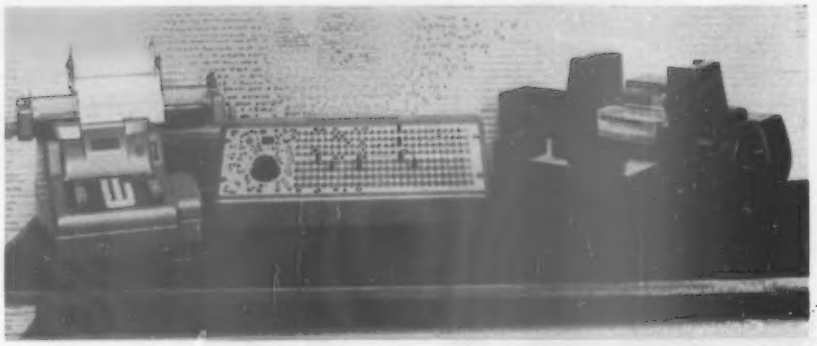
A MEDIUM speed, low cost tape reader, the Elliott D4/82, designed specifically for data transmission, but likely also to be used as input for tape comparators and small computers, is announced by Associated Automation. It incorporates temperature compensated circuits, ensuring constant output waveforms, and is able to read 5-, 6-, 7-, or 8-channel tape at a speed of up to 200 characters per second. The tape speed is infinitely variable and the stopping time is given as three milliseconds,

The Bradma-Adrema Productograph, used for the simultaneous control of machine tools, and other continuous immediate recording of production data. Information is fed to the systems by transducers fitted to individual plants, and groups of machines from 20 to 200, can be put on line.



Upper right, the B 47 the stepping card reader with 'host' Addo machine and control panel

Lower right: The B 46, a free standing card read station



the sprocket hole in the tape controlling the stopping position.

The tape is fed sideways into the tape path, giving maximum speed of insertion, and is drawn through a pair of clamping plates by pinch rollers and a rotating capstan, passing under the photo-electric reading station. The reading station consists of nine phototransistors, which sense the tape, illuminated through perspex light guides. Jointed tape can be read satisfactorily, the movement of the punch rollers being sufficient to allow the tape joint to pass between the rollers and the capstan.

The makers who stress the high reliability of the equipment, due to the simplicity of its design and the reduction to the minimum of moving parts, put the price of the reader at approximately £250.

For further details tick L05 on the reader enquiry coupon on page 41, or write to:
Associated Automation Ltd,
70 Dudden Hill Lane,
London, NW10.

A reader for low cost processing

WHEREAS manufacturers have in the past offered punched card output equipment whose performance is geared specifically to manual speed office machines, such as typewriters, add-listers and accounting machines, there has been a need felt for input equipment with the same compatibility, a hopper feed, independent punched card reader which could couple up to solenoid operated office machines. The B 47 Stepping Card Reader has been designed to meet this need.

The reader, which operates by brush sensing, is a free standing low speed machine, whose read speed is geared to the speed of the 'host' machine. It can be specified for 65, 80, or 90 column cards, and has a maximum column-to-column reading speed of 15 columns per second, and a skipping speed of 350 columns per second; the provision of input hopper, which has a capacity of 700 cards, enables input to be automatic.

The reader with the ancillary 'host' typewriter or accounting machine, will allow account posting, or invoicing to be done automatically where the quantity and frequency of operation involved would make a conventional tabulator uneconomic. A typewriter linked to the reader, for example, will allow address cards and item cards, pre-sorted and stacked in the hopper to be used to create invoices. A logical extension of these facilities is in the field of punched card machine tool control.

A useful facility offered is that the 'function generator' of the B47 can be programmed to emit a certain pattern of functional codes for each card, to control the functions of the receiving machine. In this way all the columns of a card can be used for storing data, without having to sacrifice any for machine control codes. A 'feed back' signal read at column one ensured that the host machine is ready for read-out.

For further information tick L06 on the reader enquiry coupon on page 41, or write to:
Associated Automation Ltd,
70 Dudden Hill Lane,
London, NW10.

For on line card reading

ASSOCIATED Automation have also announced their B 46 card read station, an on line photo-electric

card reader specifically designed for computer input. It functions at 400 cards per minute or 340 cards per minute—'single shotting'; column identification signals are generated as the card passes the sensing station from which an auto-strobbing process enables the computer to check the card reading movement.

The hopper trays contain 2,000 cards and full trays are merely lifted out of the reader to be replaced by an empty magazine.

The reader is free-standing and the console has space available to enable a computer manufacturer to fix matrix units.

For further details tick L07 on the reader enquiry coupon on page 41, or write to:
Associated Automation Ltd,
70 Dudden Hill Lane,
London, NW10.

For multi-thickness paper tape

FOLLOWING the announcement of a low cost paper tape punch, and a magnetic tape unit (described last month in these columns), Ultra Electronics are

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bringing out a paper tape reader, which, say the makers, is able to accept almost any punched paper tape. Standard width paper tape of varying thickness and colour, with 5-, 6-, 7- or 8-channel coding, can be processed photoelectrically at speeds up to 150 codes per second.

As manual speed machines usually operate at speeds around ten codes per minute, the Ultra reader has plenty of slack which can be used to give higher performance. Lower speeds than 150 codes per second can be set up by specification. No price has yet been fixed for the reader but it is likely to be very competitive with existing equipments.

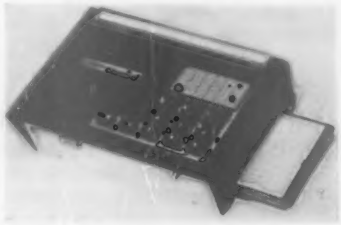
For further details tick L08 on the reader enquiry coupon on page 41, or write direct to:

Ultra Electronics Ltd,
Western Avenue,
London, W3.

Portable printing key punch

AN electrically operated hand punch, the Vari-punch, is to be marketed in this country by Account Tokens. By this method information is punched and printed on standard IBM cards, thereby allowing information to be both entered and checked at source. Thus pre-punched cards can be completed at the remote location. Visual control through the printing of the numbers punched assures that punching is carried out accurately, thereby eliminating a separate verifying operation.

The live keyboard comprises a standard 12 key arrangement, with a space, hold and tabulating button, which allows the punching to be tabulated to any prescribed card fields.



For hand punching at remote stations

The makers see this punch as a data recording device, dispensing with typewritten reports, in field office, brick factories, stock rooms, etc, and for replacing mutilated cards, making changes at data processing centres. The cost of the punch is given as £296.

For further details tick L09 on the reader enquiry coupon on page 41, or write to:

Account Tokens Ltd,
42 Fords Park Road,
London, E16.

Microfilm sales subsidiary set up

THE copying, microfilm, and visual products section of the Minnesota Mining and Manufacturing Co Ltd, have formed a division to handle the sales of the Thermo-Fax and Filmsort equipment. This group is now known as the Thermo-Fax Business Equipment Co.

Showrooms are to be set up throughout the country, the first of which opens in Bristol on 1 December. There will be three showrooms

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in Central, North and South London, and others in Birmingham, Manchester, Glasgow, Bristol, Nottingham, Leeds, Newcastle, Dublin and Belfast.

For further details tick L10 on the reader enquiry coupon on page 41, or write to:
Thermo-Fax Business Equipment Co.
3M House,
Wigmore Street,
London, W1.

Electro-mechanical reader and punches

A NEW name in the data processing field, Welmec Corporation, are producing a number of small low cost tape punches and readers.

The tape punch operates at speeds up to 15 characters per second, and is able to produce on specification 5-, 6-, 7-, or 8-channel tape. Manual backspacing is possible, so that error correction procedures are possible when the operator of the 'host' machine recognises she has made a conscious error.

The power supply is at normal mains voltage but the coded input must be at 50 volts p.c. While the 'host' office machine is not programmed to give a punched tape output, the punch is idle at zero power, giving a quiet operation.

The tape reader is an electro-mechanical device, depending on a set of sensing pins seeking for perforations in the tape. The pins are connected to solenoids to give an electrical output signal through a 33-way plug. Reading speed is up to 15 codes per second. The reader is available as a 5-channel model costing £105 or an 8-channel model costing £120.

For further details tick L11 on the reader enquiry coupon on page 41, or write to:
Welmec Corporation,
147 Strand,
London, WC2.

Tape Measure

THIS prototype equipment, known as the PET punch (portable encoded tape) is designed to allow meter readings and other statistical recordings in process control, forestry, etc, to be encoded on paper tape at the point of operation.

The linear measurement is carried out by means of a steel measuring tape, to which code wheels are geared within the equipment. The tape is extended and the pistol grip on the carrying handle of the equipment applied, thereby punching on the paper tape the code corresponding to the extension. A ratchet mechanism prevents two codes being engaged simultaneously. At the end of the reading the paper tape is stepped forward, and punched portion is taken up on a detachable reel. Where gas or electricity meters are read, they will be punched by means of a setting dial, which can also be used for punching start and end of message codes.

The equipment is contained in a cylindrical metal case, seven inches by four inches, to which a carrying handle is attached; the case is waterproof and so can be used for outdoor applications. The coding wheels will be coded in binary or any other code as specified by the customer.

For further details tick L12 on the reader enquiry coupon on page 41, or write to:
Associated Automation Ltd,
70 Dudden Hill Lane,
London, NW10.

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AUTOMATIC DATA PROCESSING
Reader Service Department
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Survey of Data Processing Salaries

AUTOMATIC DATA PROCESSING is conducting a survey of the salaries earned by computer installations managers, systems analysts, senior programmers and programmers. The results of this survey which will be published in an early issue of ADP will be of great value both to the people who work with computers and the companies that employ them in establishing what people of various qualifications and experience are entitled to in salary rewards.

Junior and senior programmers as well as systems analysts and data processing managers are invited to fill in the form below, and mail it to ADP. The survey is being conducted on an anonymous basis so that there is no need to give your name: this is not asked for.

CUT HERE

I. Position

TICK WHERE APPROPRIATE

Are you a Programmer ☐ Senior Programmer ☐ Systems Analyst ☐ Installation Manager ☐

II. Qualifications

Do you have an advanced level GCE in — Two subjects ☐ / Three or more subjects ☐ — including Physics ☐ / Mathematics ☐ / Economics ☐

Do you have a degree in Physics ☐ Mathematics ☐ Economics ☐ Any other subject ☐

Do you have any of the following institute qualifications? F.C.W.A. / A.C.W.A. ☐ F.C.A. / A.C.A. ☐ F.A.C.C.A. / A.A.C.C.A. ☐ F.C.I.S. / A.C.I.S. ☐ F.C.C.S. / A.C.C.S. ☐

Do you have experience in (at least one year) Accountancy ☐ Punched Cards ☐ O & M ☐

III.

When were you first trained to program? 19.....

How many machines have you been trained to program? .....

VI.

What is your total annual remuneration? £.....

When did you last change your job? (from firm to firm) 19.....

V.

Do your projects involve
- scientific computer programs? ☐
- technical programs (compilers and non-scientific subroutines)? ☐
- market research or statistical programs? ☐
- commercial programs? ☐

Are you responsible for the day-to-day operations of a computer? Yes ☐

Do you have executive responsibility for systems analysts? Yes ☐

Do you have executive responsibility for programmers? Yes ☐

Are you responsible for analysing present procedures? Yes ☐

And for designing computer procedures? Yes ☐

Do you compile your own block diagrams? Yes ☐

Do you code from other peoples' block diagrams? Yes ☐

or from your own? Yes ☐

VI.

Present age.....

VII.

Are you employed by a computer manufacturer? Yes ☐

If you are
a computer installation manager
a systems analyst, or
a computer programmer

please fill in the form on the other side of this page

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Survey of

DATA PROCESSING SALARIES

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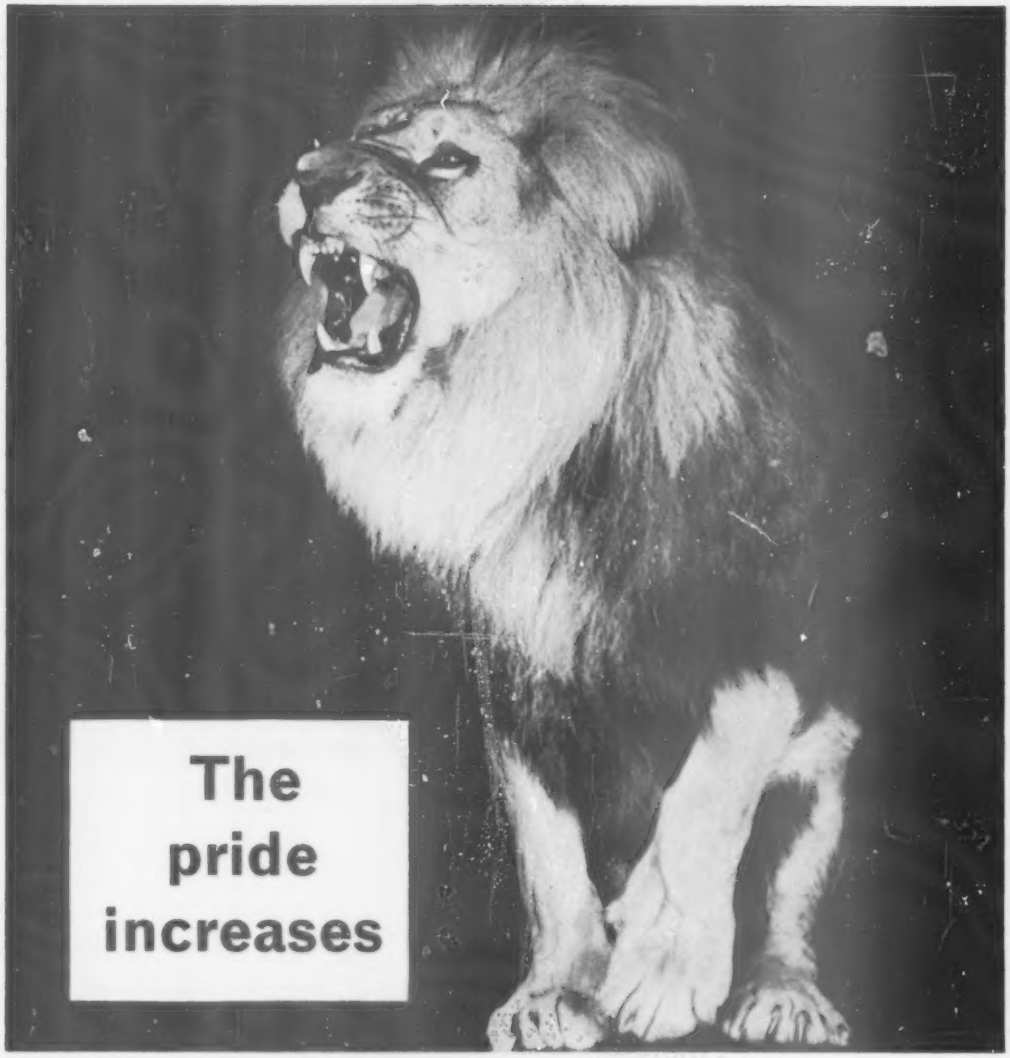

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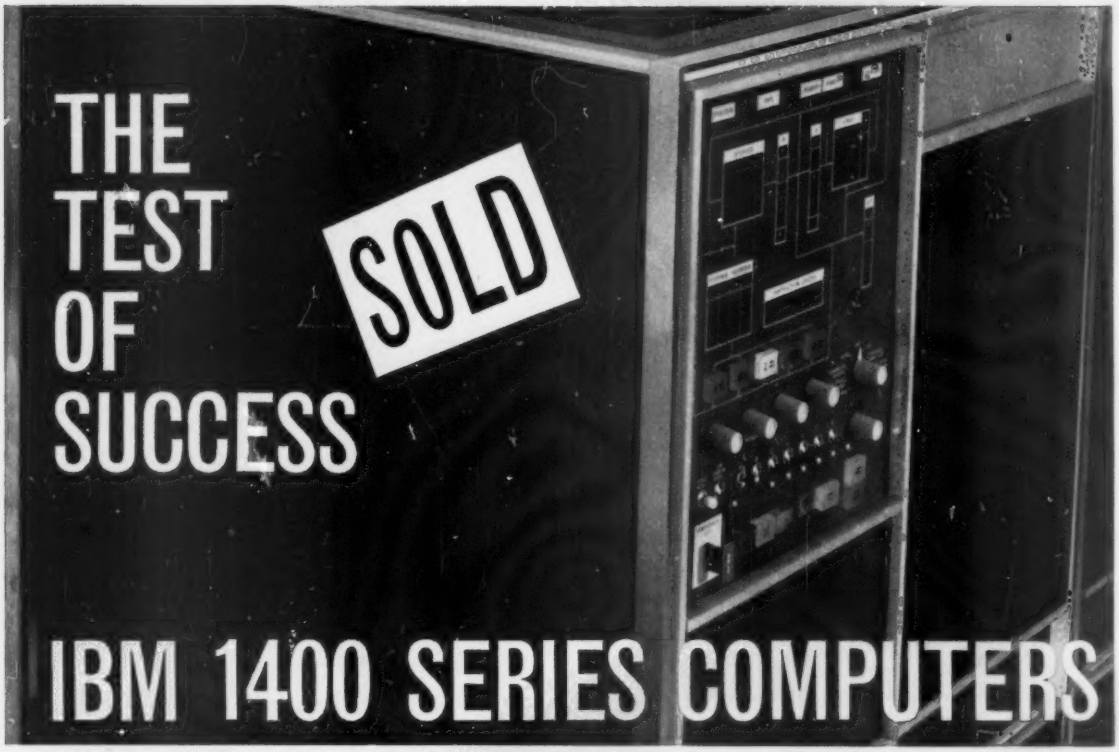

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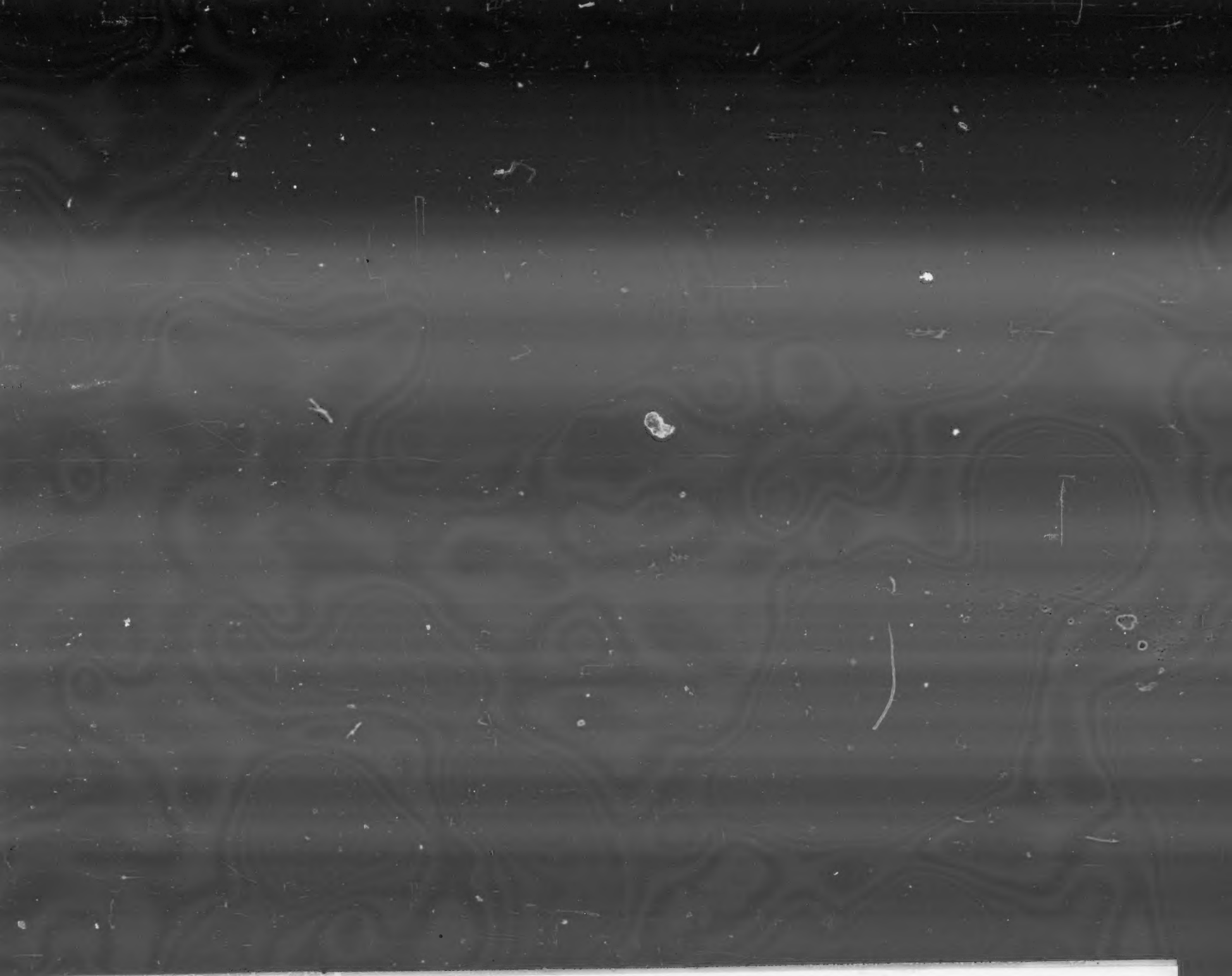
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